ENERGYPLUS™

Output Details and Examples

An In-depth Guide to EnergyPlus Outputs (including error messages), Example Inputs and Data Set Files

Date: September 29, 2004

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Introduction

This document is intended to give an in-depth look at the various output files produced by EnergyPlus. Some of these may be referenced in various other parts of the documentation but are presented here with more details.

The scripts that assist in running EnergyPlus will usually rename the standard names used in the program. The two scripts that are distributed with EnergyPlus are: **EPL-Run.bat** (which is used by the EP-Launch program) and **RunEPlus.bat** (which can be used from the command line). The RunEPlus batch file can also be used to string together several runs such as usually termed “batch processing”. In renaming the files created by the program or its post-processing program(s), usually the file extension will be retained. The following table will illustrate the native EnergyPlus file name, a description of its contents and the EP-Launch “version” of the file. In this table, <filename> refers to the source/original file name (without extension) selected. Files are presented in alphabetic order. For output purposes, the most important files to understand are the eplusout.eso, eplusout.mtr and eplusout.err files. The first two are manipulated with the ReadVarsESO post processing program. The latter will contain any critical errors that were encountered during the run.

Output File List

Table 1. EnergyPlus Basic Output Files

Output File Name	Description	EP-Launch File Name
eplusout.audit	Echo of input, includes both IDD echo and IDF echo – may have errors shown in context with IDD or IDF statements	<filename>.audit (without echoing IDD unless errors in IDD).
eplusout.bnd	This file contains details about the nodes and branches. Useful in determining if all your nodes are connected correctly. May be used to diagram the network/ nodes of the HVAC system.	<filename>.bnd
eplusout.cif	This file is a by-product of using COMIS airflow. It contains the first commands sent during the EnergyPlus simulation and can be used with a stand-alone COMIS program.	<filename>.cif
eplusout.dbg	From Debug Output object – may be useful to support to help track down problems	<filename>.dbg
eplusout.dxf	DXF (from Report,Surfaces,DXF;)	<filename>.dxf
eplusout.eio	Contains several standard and optional “report” elements. CSV format – may be read directly into spreadsheet program for better formatting.	<filename>.eio
eplusout.end	A one line summary of success or failure (useful for Interface programs)	Not saved in the standard EPL-Run script file.
eplusout.epmidf	Output from EPMacro program – contains the idf created from the input imf file	<filename>.epmidf
eplusout.epmdet	Output from EPMacro program – the audit/details of the EPMacro processing	<filename>.epmdet

eplusout.epmidf	Error file – contains very important information from running the program.	<filename>.err
If you use an EPMacro file (usual extension is .imf) as your basis for input, then this file is the “idf” that the EPMacro program produces.		
eplusout.epmdet		
If you use an EPMacro file (usual extension is .imf) as your basis for input, then this file is the details of the EPMacro run (including any error messages).		
eplusout.err		
eplusout.eso	Standard Output File (contains results from both Report Variable and Report Meter objects).	<filename>.eso
	Log of items that appear in the command file output from the run.	<filename>.log

eplusout.log	Meter details report – what variables are on what meters and vice versa.	<filename>.mtd

When EnergyPlus is running, it is usually running from a "command" window (unless inside another interface program) and some items may appear in the command window. These messages are preserved in the "log" output file. For example:

```
ergyPlus Starting
ergyPlus, Version 1.2.1
rming up
itializing Response Fact
lculating CTFs for
TWALL80", Construction #
lculating CTFs for
RTITION06", Construction
lculating CTFs for "FLOO
3 8 IN", Construction #3
lculating CTFs for
OF34", Construction #4
itializing Window Optica
perties
itializing Solar
culations
itializing HVAC
rming up
rming up
rforming Zone Sizing
ulation
rming up
rming up
rming up
rforming Zone Sizing
ulation
itializing New Environme
ameters
rming up
rming up
rming up
```

```
rming up
arting Simulation at 01/
 CHICAGO IL USA TMY2-948
#=725300
itializing New Environme
ameters
rming up
rming up
rming up
rming up
arting Simulation at 07/
 CHICAGO IL USA TMY2-948
#=725300
ergyPlus Run Time=00hr
in  7.30sec
dVarsESO program startin
dVars Run Time=00hr 00mi
4sec
dVarsESO program complet
cessfully.
dVarsESO program startin
dVars Run Time=00hr 00mi
1sec
dVarsESO program complet
cessfully.
tarted HVAC Diagram
omplete
```

eplusout.mtd		
eplusout.mtr	Similar to .eso but only has Report Meter outputs.	<filename>.mtr
eplusout.rdd	Report Variable names that are applicable to the current simulation.	<filename>.rdd
eplusout.sln	Similar to DXF output but less structuresd. Results of Report Surface, Lines object.	<filename>.sln
eplusssz.<ext>	Results from the System Sizing object. This file is “spreadsheet” ready. Different extensions (csv, tab, and txt) denote different “separators” in the file.	<filename>Ssz.<ext>
epluszsz.<ext>	Results from the Zone Sizing object. This file is “spreadsheet” ready. Different extensions (csv, tab, and txt) denote different “separators” in the file.	<filename>Zsz.<ext>
eplusmap.<ext>	Daylighting intensity “map” output. Different extensions (csv, tab, and txt) denote different “separators” in the file.	<filename>Map.<ext>
eplustbl.<ext>	Results of Report Table and Economics requests. Different extensions (csv, tab, and txt) denote different “separators” in the file.	<filename>Table.<ext>
eplusout.svg	Results from the HVAC-Diagram application. SVG is a Scalable Vector Graphics file for which several viewers can be found.	<filename>.svg
eplusout.sci	File of cost information	<filename>.sci
eplusout.cfp	File of constrained free parameters for optimization	<filename>.cfp
eplusout.delightin	File produced during DElight simulations – descriptive of EnergyPlus inputs into DElight inputs.	<filename>.delightin
eplusout.delightout	File produced during DElight simulations –	<filename>.delightout

	basic results from DElight simulation.	
eplusout.delightdfdmp	File produced during DElight simulations – includes any warning or error messages from DElight	<filename>.delightdfdmp
eplusout.delighteldmp	File produced during DElight simulations – timestep results from the simulation	<filename>.delighteldmp

In addition to the basic output files from EnergyPlus there are two standard “hybrid” output files. These are called “hybrid” because they are a result of post-processing after EnergyPlus has completed. Note that if there is an error during processing, these will not normally be “complete”.

Table 2. "Hybrid" EnergyPlus Output Files

Output File Name	Description	EP-Launch File Name
eplusout.<ext>	“spreadsheet” ready file that contains either all the report variables requested (default: up to limit of 255) from the input file or specific ones specified by the user. Different extensions (csv, tab, and txt denote different “separators” in the file.	<filename>.csv or <filename>.tab or <filename>.txt
eplusmtr.<ext>	“spreadsheet” ready file that contains either all the report meter requests (default: up to 255) from the input file or specific ones specified by the user. Different extensions (csv, tab, and txt denote different “separators” in the file.	<filename>Meter.csv or <filename>Meter.tab or <filename>Meter.txt

Now, each file will be described in more detail with some examples of use.

eplusout.audit

This file is simply the echo of the inputs to the EnergyPlus program – the Energy+.idd (data dictionary) and in.idf (<filename>.idf – the input data file). Every attempt has been made to not require this file to be saved – errors are interpreted as much as possible and encapsulated onto the eplusout.err file. Any errors in the data dictionary processing should be accomplished during development – users should never see errors there. Thus, this file is not “saved” after processing by the standard script file. Occasionally, you may wish to view this file because of something obscure.

An excerpt of the file follows. Lines in green are notes produced from EnergyPlus. Lines in red are lines with error messages shown to illustrate context. The other lines are echoes from inputs (with line numbers).

```
  Processing Data Dictionary (Energy+.idd) File -- Start
     1 !IDD_Version 1.0.1.042
     2 ! **************************************************************************
     3 !
<reduced for brevity>
 13000        \key DETAILS
 13001        \key Vertices
 13002        \key DetailsWithVertices
  Processing Data Dictionary (Energy+.idd) File -- Complete
  Maximum number of Alpha Args=           56
  Maximum number of Numeric Args=         1800
  Number of Object Definitions=          205
  Number of Section Definitions=           3
  Processing Input Data File (in.idf) -- Start
     1 ! Basic file description: Basic illustration of using Purchased Air as a system
     2 ! Run:      2 design days.
     3 !           2 annual run periods, 2 summer days and 3 winter days.
<reduced for brevity>
    63     RunPeriod,          ! 3 day winter simulation
    64               1,                 1,   ! Start Month ,Day
    65               1,                 3;   ! End Month ,Day
   ** Warning ** Object=RUNPERIOD, entered with less than minimum number of fields.
   **   ~~~   ** Attempting fill to minimum.
    66  MATERIAL:Regular,A1 - 1 IN STUCCO,  !- Material Name
<reduced for brevity>
   784 End Simulation Data;
  Processing Input Data File (in.idf) -- Complete
  Number of IDF "Lines"=         147
 Getting object=TIMESTEP IN HOUR
 Getting object=VERSION
 Getting object=DESIGNDAY
  Processing Schedule Input -- Start
 Getting object=SCHEDULETYPE
 Getting object=DAYSCHEDULE
 Getting object=WEEKSCHEDULE
 Getting object=SCHEDULE
  Processing Schedule Input -- Complete
 Getting object=PEOPLE
 Getting object=LIGHTS
```

eplusout.bnd

The "branch node details" (bnd) file is intended to give enough information that one could (with a chosen software) diagram the nodes and components of the HVAC system. It may or may not achieve that objective. Of more use may be its illustration of node connection/branch errors that aren't detected by the software. This file has the details to support any "node connection" errors that will be noted in the eplusout.err file. Branch validation is shown in this file. Branches are checked to assure that each output node of the branch element is an input node to the next branch element. Cross-branch checking is not done directly within the program though the details will illustrate some problems of that nature.

Supply and Return Air Paths are also checked and feedback about each item are shown.

As is standard with many EnergyPlus output files, this file is CSV (comma-delimited) such that it can be read by spreadsheet programs for further manipulation by the user.

An example will illustrate. Notes about the reporting are highlighted in green.

```
Program Version,EnergyPlus, Version 1.2.1
! This file shows details about the branches, nodes, and other
! elements of the flow connections.
! This file is intended for use in "debugging" potential problems
! that may also be detected by the program, but may be more easily
! identified by "eye".
! This file is also intended to support software which draws a
! schematic diagram of the HVAC system.
! ===============================================================
! #Nodes,<Number of Unique Nodes>
 #Nodes,44
List of all nodes follows.  # references may be an indication of faulty node spec (or not)
! <Node>,<NodeNumber>,<Node Name>,<Node Fluid Type>,<# Times Node Referenced After Definition>
 Node,1,HW SUPPLY OUTLET NODE,Water,6
 Node,2,ZONE1WINDACOAINNODE,Air,2
<reduced for brevity>
 Node,43,ZONE3WINDACDXOUTLETNODE,Air,1
 Node,44,ZONE1WINDACFANOUTLETNODE,Air,1
! ===============================================================
! Suspicious nodes have 0 references.  It is normal for some nodes, however.
! Listing nodes with 0 references (culled from previous list):
! <Suspicious Node>,<NodeNumber>,<Node Name>,<Node Fluid Type>,<# Times Node Referenced After Definition>
 Suspicious Node,30,ZONE 1 NODE,Air,0
 Suspicious Node,31,ZONE 1 OUTLET NODE,Air,0
 Suspicious Node,32,ZONE 2 NODE,Air,0
 Suspicious Node,33,ZONE 2 OUTLET NODE,Air,0
 Suspicious Node,34,ZONE 3 NODE,Air,0
 Suspicious Node,35,ZONE 3 OUTLET NODE,Air,0
List of branches follow.
! <#Branch Lists>,<Number of Branch Lists>
 #Branch Lists,2
! <Branch List>,<Branch List Count>,<Branch List Name>,<Loop Name>,<Loop Type>
! <#Branches on Branch List>,<Number of Branches>
! <Branch>,<Branch Count>,<Branch Name>,<Loop Name>
! <Branch Inlet/Outlet Nodes>,<Branch Inlet Node Name>,<Branch Outlet Node Name>
 Branch List,1,HEATING SUPPLY SIDE BRANCHES,HOT WATER LOOP,Plant Supply
 #Branches on Branch List,4
 ..Branch,1,HEATING SUPPLY INLET BRANCH,HOT WATER LOOP
 ....Branch Inlet/Outlet Nodes,HW SUPPLY INLET NODE,HW PUMP OUTLET NODE
 ..Branch,2,HEATING PURCHASED HOT WATER BRANCH,HOT WATER LOOP
 ....Branch Inlet/Outlet Nodes,PURCHASED HEAT INLET NODE,PURCHASED HEAT OUTLET NODE
 ..Branch,3,HEATING SUPPLY BYPASS BRANCH,HOT WATER LOOP
 ....Branch Inlet/Outlet Nodes,HEATING SUPPLY BYPASS INLET NODE,HEATING SUPPLY BYPASS OUTLET NODE
 ..Branch,4,HEATING SUPPLY OUTLET BRANCH,HOT WATER LOOP
 ....Branch Inlet/Outlet Nodes,HEATING SUPPLY EXIT PIPE INLET NODE,HW SUPPLY OUTLET NODE
 Branch List,2,HEATING DEMAND SIDE BRANCHES,HOT WATER LOOP,Plant Demand
 #Branches on Branch List,6
 ..Branch,1,ZONESHWINLETBRANCH,HOT WATER LOOP
 ....Branch Inlet/Outlet Nodes,HW DEMAND INLET NODE,HW DEMAND ENTRANCE PIPE OUTLET NODE
 ..Branch,2,ZONE1HWBRANCH,HOT WATER LOOP
 ....Branch Inlet/Outlet Nodes,ZONE1BBHWINLETNODE,ZONE1BBHWOUTLETNODE
 ..Branch,3,ZONE2HWBRANCH,HOT WATER LOOP
 ....Branch Inlet/Outlet Nodes,ZONE2BBHWINLETNODE,ZONE2BBHWOUTLETNODE
 ..Branch,4,ZONE3HWBRANCH,HOT WATER LOOP
 ....Branch Inlet/Outlet Nodes,ZONE3BBHWINLETNODE,ZONE3BBHWOUTLETNODE
 ..Branch,5,ZONESHWBYPASSBRANCH,HOT WATER LOOP
 ....Branch Inlet/Outlet Nodes,ZONESHWBYPASSINLETNODE,ZONESHWBYPASSOUTLETNODE
 ..Branch,6,ZONESHWOUTLETBRANCH,HOT WATER LOOP
 ....Branch Inlet/Outlet Nodes,HW DEMAND EXIT PIPE INLET NODE,HW DEMAND OUTLET NODE
! ===============================================================
! <#Supply Air Paths>,<Number of Supply Air Paths>
 #Supply Air Paths,0
! <Supply Air Path>,<Supply Air Path Count>,<Supply Air Path Name>,<Air Primary Loop Name>
! <#Components on Supply Air Path>,<Number of Components>
! <Supply Air Path Component>,<Component Count>,<Component Type>,<Component Name>,<Air Primary
Loop Name>
! <#Outlet Nodes on Supply Air Path Component>,<Number of Nodes>
! <Supply Air Path Component Nodes>,<Node Count>,<Component Type>,<Component Name>,<Inlet Node
Name>,<Outlet Node Name>,<Air Primary Loop Name>
```

```
! ===============================================================
! <#Return Air Paths>,<Number of Return Air Paths>
 #Return Air Paths,0
! <Return Air Path>,<Return Air Path Count>,<Return Air Path Name>,<Air Primary Loop Name>
! <#Components on Return Air Path>,<Number of Components>
! <Return Air Path Component>,<Component Count>,<Component Type>,<Component Name>,<Air Primary
Loop Name>
! <#Inlet Nodes on Return Air Path Component>,<Number of Nodes>
! <Return Air Path Component Nodes>,<Node Count>,<Component Type>,<Component Name>,<Inlet Node
Name>,<Outlet Node Name>,<Air Primary Loop Name>
! ===============================================================
! #Outside Air Nodes,<Number of Outside Air Nodes>
 #Outside Air Nodes,3
! <Outside Air Node>,<NodeNumber>,<Node Name>
 Outside Air Node,2,ZONE1WINDACOAINNODE
 Outside Air Node,3,ZONE2WINDACOAINNODE
 Outside Air Node,4,ZONE3WINDACOAINNODE
! ===============================================================
Component sets.  Very important for node connection error detection.
! <#Component Sets>,<Number of Component Sets>
 #Component Sets,16
! <Component Set>,<Component Set Count>,<Parent Object Type>,<Parent Object Name>,<Component
Type>,<Component Name>,<Inlet Node ID>,<Outlet Node ID>,<Description>
 Component Set,1,BRANCH,HEATING SUPPLY INLET BRANCH,PUMP:VARIABLE SPEED,HW CIRC PUMP,HW SUPPLY INLET
NODE,HW PUMP OUTLET NODE,Water Nodes
 Component Set,2,BRANCH,HEATING PURCHASED HOT WATER BRANCH,PURCHASED:HOT WATER,PURCHASED HEATING,PURCHASED
HEAT INLET NODE,PURCHASED HEAT OUTLET NODE,Hot Water Nodes
 Component Set,3,BRANCH,HEATING SUPPLY BYPASS BRANCH,PIPE,HEATING SUPPLY SIDE BYPASS,HEATING SUPPLY BYPASS
INLET NODE,HEATING SUPPLY BYPASS OUTLET NODE,Pipe Nodes
 Component Set,4,BRANCH,HEATING SUPPLY OUTLET BRANCH,PIPE,HEATING SUPPLY OUTLET,HEATING SUPPLY EXIT PIPE
INLET NODE,HW SUPPLY OUTLET NODE,Pipe Nodes
 Component Set,5,BRANCH,ZONESHWINLETBRANCH,PIPE,ZONESHWINLETPIPE,HW DEMAND INLET NODE,HW DEMAND ENTRANCE
PIPE OUTLET NODE,Pipe Nodes
 Component Set,6,BRANCH,ZONESHWOUTLETBRANCH,PIPE,ZONESHWOUTLETPIPE,HW DEMAND EXIT PIPE INLET NODE,HW
DEMAND OUTLET NODE,Pipe Nodes
 Component Set,7,BRANCH,ZONE1HWBRANCH,BASEBOARD
HEATER:WATER:CONVECTIVE,ZONE1BASEBOARD,ZONE1BBHWINLETNODE,ZONE1BBHWOUTLETNODE,Hot Water Nodes
 Component Set,8,BRANCH,ZONE2HWBRANCH,BASEBOARD
HEATER:WATER:CONVECTIVE,ZONE2BASEBOARD,ZONE2BBHWINLETNODE,ZONE2BBHWOUTLETNODE,Hot Water Nodes
 Component Set,9,BRANCH,ZONE3HWBRANCH,BASEBOARD
HEATER:WATER:CONVECTIVE,ZONE3BASEBOARD,ZONE3BBHWINLETNODE,ZONE3BBHWOUTLETNODE,Hot Water Nodes
 Component
Set,10,BRANCH,ZONESHWBYPASSBRANCH,PIPE,ZONESHWBYPASSPIPE,ZONESHWBYPASSINLETNODE,ZONESHWBYPASSOUTLETNODE,Pi
pe Nodes
 Component Set,11,AIR
CONDITIONER:WINDOW:CYCLING,ZONE1WINDAC,FAN:SIMPLE:CONSTVOLUME,ZONE1WINDACFAN,ZONE1WINDACOAMIXEROUTLETNODE,
ZONE1WINDACFANOUTLETNODE,Air Nodes
 Component Set,12,AIR
CONDITIONER:WINDOW:CYCLING,ZONE1WINDAC,COIL:DX:COOLINGBYPASSFACTOREMPIRICAL,ZONE1WINDACDXCOIL,ZONE1WINDACF
ANOUTLETNODE,ZONE1WINDACAIROUTLETNODE,Air Nodes
 Component Set,13,AIR
CONDITIONER:WINDOW:CYCLING,ZONE2WINDAC,FAN:SIMPLE:CONSTVOLUME,ZONE2WINDACFAN,ZONE2WINDACOAMIXEROUTLETNODE,
ZONE2WINDACFANOUTLETNODE,Air Nodes
 Component Set,14,AIR
CONDITIONER:WINDOW:CYCLING,ZONE2WINDAC,COIL:DX:COOLINGBYPASSFACTOREMPIRICAL,ZONE2WINDACDXCOIL,ZONE2WINDACF
ANOUTLETNODE,ZONE2WINDACAIROUTLETNODE,Air Nodes
 Component Set,15,AIR
CONDITIONER:WINDOW:CYCLING,ZONE3WINDAC,FAN:SIMPLE:CONSTVOLUME,ZONE3WINDACFAN,ZONE3WINDACDXOUTLETNODE,ZONE3
WINDACAIROUTLETNODE,Air Nodes
 Component Set,16,AIR
CONDITIONER:WINDOW:CYCLING,ZONE3WINDAC,COIL:DX:COOLINGBYPASSFACTOREMPIRICAL,ZONE3WINDACDXCOIL,ZONE3WINDACO
AMIXEROUTLETNODE,ZONE3WINDACDXOUTLETNODE,Air Nodes
Similar details for Plant Loops, Condenser Loops, Controlled Zones, etc.
```

eplusout.cif

At the beginning of the simulation EnergyPlus generates an internal COMIS input file, **eplusout.cif**, based on the COMIS-related inputs described above. To retain this file, add the following line to your idf file:

```
Report, COMISinput;
```

eplusout.cif can be used as a summary and verification of your COMIS/EnergyPlus inputs. It can also be used as input to the original COMIS program for testing and debugging purposes. If EP-Launch is used or the batch files are used to run the EnergyPlus simulation, then this file will be saved as **<filename>.cif**.

An example of this file is shown in Figure 1. This is followed by a description of the contents of the file.

```
&-PR-IDENtification                1
EnergyPlus/COMIS input file
&-PR-SIMUlation options            2
VENT
NO POL
NO CONC
NO INPUT
NO DEFAULT
NO UNIT
START   19570701_00:00
STOP    19570701_00:00
&-PR-CONTrol parameters            3
1.     0.1E-05     0.1E-03     0.2E-06  1     0.1E-03
        1         0       500
&-CR       CRACK                   7
*CR-1
     0.010     0.667     1.000
     0.000     0.000     0.000
*CRCRI
     0.050     0.667     1.000
     0.000     0.000     0.000
&-WI       WINDOW                  8
*WIWIOPEN1_1
     0.001     0.667         1     4.000     1.500     0.000
     0.000     0.500     0.000     1.000     0.000
     1.000     0.600     1.000     1.000     0.000
     0.000     0.000     0.000     0.000     0.000
*WIWIOPEN2_1
     0.001     0.667         1     3.000     1.333     0.000
     0.000     0.500     0.000     1.000     0.000
     1.000     0.600     1.000     1.000     0.000
     0.000     0.000     0.000     0.000     0.000
*WIDROPEN_1
     0.001     0.667         1     1.000     2.000     0.000
     0.000     0.500     0.000     1.000     0.000
     1.000     0.600     1.000     1.000     0.000
     0.000     0.000     0.000     0.000     0.000
&-NET-ZONes                        9
Z1    WEST_ZONE                            23.00      0.00    113.27      0.01
Z2    EAST_ZONE                            23.00      0.00    113.27      0.01
Z3    NORTH_ZONE                           23.00      0.00    226.53      0.01
&-NET-EXTernal node data          10
ex1    fac1          1.00
ex2    fac2          1.00
ex3    fac3          1.00
ex4    fac4          1.00
&-NET-LINks                       11
SURFACE_1           CR-1            -ex3    Z1       1.524  1.524  1.00  1.000
WINDOW1             WIWIOPEN1_1     -ex3    Z1       1.750  1.750  1.00  0.500
SURFACE_2           CR-1            -ex4    Z1       1.524  1.524  1.00  1.000
SURFACE_3           CRCRI           Z3      Z1       1.524  1.524  1.00  1.000
DOORINSURFACE_3     WIDROPEN_1      Z3      Z1       1.000  1.000  1.00  0.500
```

```
53 SURFACE_4            CRCRI          Z2     Z1      1.524  1.524  1.00  1.000
54 SURFACE_8            CR-1           -ex3   Z2      1.524  1.524  1.00  1.000
55 SURFACE_9            CR-1           -ex2   Z2      1.524  1.524  1.00  1.000
56 SURFACE_11           CRCRI          Z3     Z2      1.524  1.524  1.00  1.000
57 SURFACE_14           CR-1           -ex4   Z3      1.524  1.524  1.00  1.000
58 SURFACE_15           CR-1           -ex1   Z3      1.524  1.524  1.00  1.000
59 WINDOW2              WIWIOPEN2_1    -ex1   Z3      1.667  1.667  1.00  0.500
60 SURFACE_16           CR-1           -ex2   Z3      1.524  1.524  1.00  1.000
61 &-CP-BUILding reference height for Cp data 12
62   10.00000
63 &-CP-VALUEs                     13
64 cpva
65 * 0.00 30.0  60.0  90.0 120.0 150.0 180.0 210.0 240.0 270.0 300.0 330.0
66 fac1 0.60 0.48 0.04 -0.56 -0.56 -0.42 -0.37 -0.42 -0.56 -0.56 0.04 0.48
67 fac2 -0.56 0.04 0.48 0.60 0.48 0.04 -0.56 -0.56 -0.42 -0.37 -0.42 -0.56
68 fac3 -0.37 -0.42 -0.56 -0.56 0.04 0.48 0.60 0.48 0.04 -0.56 -0.56 -0.42
69 fac4 -0.56 -0.56 -0.42 -0.37 -0.42 -0.56 -0.56 0.04 0.48 0.60 0.48 0.04
70 &-ENV-BUIlding related parameters  4
71    228.000     0.000    40.300   -88.150
72 &-ENV-WINd and meteo related parameters  5
73     10.000   228.000     0.140
74      0.000     0.200     0.180     0.000
75    180.000     0.200     0.320    15.000
76 &-SCH-METeo data                 6
77 met data for time step
78 19570701_00:00   0.0    0.  18.2 11.7  98.79
79 &-NORM-CR Standard conditions for crack data
80   20.00000       101.3200       5.000000
```

Figure 1. Sample COMIS input file, eplusout.cif, produced by COMIS/EnergyPlus.

The above sample differs from the actual file in that reference line numbers have been added and blank space in some of the lines has been removed to avoid line wrapping. The contents of the file are described in the succeeding section.

Description of Contents of Sample COMIS Input File

An example COMIS input file is shown in Figure 1. The following describes the contents of the lines in this file. When the contents are associated with a COMIS input object the name of the object is given in boldface; this is followed by the names of one or more input fields associated with that object. For example, Line 4 of the sample file contains the value of the "Ventilation Simulation Control" field of the COMIS Simulation object.

Line 4: **COMIS Simulation**: Ventilation Simulation Control.

Line 5: **COMIS Simulation**: Pollution Simulation Control.

Line 6: **COMIS Simulation**: Concentration Simulation Control.

Line 13-14: **COMIS Simulation**

> Line 13: Under-Relaxation Factor, Absolute Flow Tolerance (kg/s), Relative Flow Tolerance, Error Estimate for Total Flow per Zone (kg/s), Start Number of Iterations, Limit for Laminar Flow Approximation (Pa).
>
> Line 14: Flag for Using Old Pressures (1 = use pressures from previous time step at start of iterations in current time step), Flag for Pressure Initiation (0 = do linearized solution at beginning of iterations), Maximum Number of Iterations.

Lines 16-18 and 19-21: **COMIS Air Flow:Crack**: Name, Air Mass Flow Coefficient (kg/s @ 1.0 Pa), Air Mass Flow Exponent, Crack Length (m), Pollutant #1, #2 and #3 Filter Efficiencies.

Lines 23-27: **COMIS Air Flow:Opening**: input data for WIOPEN1.

Line 23: Name. Note that program has added prefix “WI” and suffix “_1”. If two or more COMIS Surface Data’s refer to the same COMIS Air Flow:Opening then multiple air-flow opening blocks will be created, with suffices “_1”, “_2”, etc.

Line 24: Air Mass Flow Coefficient When Window or Door is Closed (kg/s @ 1.0 Pa per m of crack); Air Mass Flow Exponent When Window or Door is Closed; Type of Large Vertical Opening (LVO); width of window/door (m); height of window/door (m); Extra Crack length for LVO Type 1 with Multiple Openable Parts, or Height of Pivoting Axis for LVO type 2.

Line 25: Opening Factor #1, Discharge Coefficient for Opening Factor #1, Width Factor for Opening Factor #1, Height Factor for Opening Factor #1, Start Height Factor for Opening Factor #1.

Line 26: Opening Factor #2, …

Line 27: Opening Factor #3, … (note: data for only two opening factors has been specified)

Lines 28-32: **COMIS Air Flow:Opening**: input data for WIOPEN2.

Lines 33-37: **COMIS Air Flow:Opening**: input data for DROPEN.

Lines 39-41: **COMIS Zone Data**: COMIS zone name in the form zN, where N = zone number of associated thermal zone; Name of Associated Thermal Zone; starting zone air temperature (C); calculated reference height (m); volume (m^3); starting value of zone air humidity ratio.

Lines 43-46: **COMIS External Node**: external node number in the form exN, façade element number in the form facN, Outside Pollutant Concentration Factor (not used).

Lines 48-60: **COMIS Surface Data**--information for the air flow links, where a link can be a crack or window/door opening. Each line gives:

- Name of the heat transfer surface associated with the link.
- Name of the COMIS Air Flow:Crack or COMIS Air Flow:Opening corresponding to the link. Opening names start with WI. Other names are crack names.
- COMIS name of the link’s FromZone. In COMIS, air flows across a link between two zones, one of which is the “FromZone” and the other is the “ToZone.” A name of the form –exN means external air node N. See “FromZone’s and ToZone’s,” below.
- COMIS name of the link’s ToZone. A name of the form –exN means external air node N. In COMIS, air flows across a link between two zones, one of which is the “FromZone” and the other is the “ToZone.” A name of the form –exN means external node N. See “FromZone’s and ToZone’s,” below.
- Vertical distance between link and FromZone’s reference plane (m)
- Vertical distance between link and ToZone’s reference plane (m)
- For a window/door opening, the cosine of the angle between the plane of the opening and the vertical plane (same as sine of the window/door tilt angle).

Lines 62: **COMIS Simulation**: Reference Height for Recorded Wind Data (m)

Lines 65-69: **COMIS CP Values**

Line 65: Wind directions (degrees from North)

Lines 66-69: Façade element number in the form facN, Cp values for corresponding wind directions.

Line 71: Building parameters: height above sea level (m), azimuth (deg), latitude (deg), longitude (deg).

Lines 73-75: Wind and meteorological parameters

Line 73: Reference height for wind speed measurement (m), altitude of meteorological station (m), exponent in the power-law function of the wind velocity profile.

Lines 74-75: **COMIS Site Wind Conditions**: Wind direction (deg from North), Plan Area Density, Exponent of Wind Velocity Profile, Surrounding Building Height (m).

Line 78: Weather data for first time step: Year/month/day/hour/minutes of first time step, wind speed (m/s), wind direction (deg from North), outside drybulb temperature (C), outside humidity ratio (g/kg), barometric pressure (kPa).

Line 80: **COMIS Standard Conditions for Crack Data**: Standard Temperature for Crack Data (C), Standard Barometric Pressure for Crack Data (kPa), Standard Humidity Ratio for Crack Data (g/kg).

eplusout.dbg

This file is used by developers during debugging and can be "turned on" by the DEBUG OUTPUT object in the input file. The only reason a user might specify this flag would be to send a file to the support group.

eplusout.dxf

The DXF output report file is formatted according to the "Data Exchange Format" standard rules for representing CADD type coordinates. The file can be used in several inexpensive, shareware or freeware viewers. Quickview Plus ™ can display DXF files as shown in Figure 2 below. A free program from Autocad™, Voloview Express™, can display solid model rendering as shown in Figure 3. Other viewers are available from Microstation™, Visio™ and other shareware or freeware vendors. Voloview Express is downloadable from www.autocad.com.

This file is generated when the following line is included in the IDF.

```
Report, Surfaces, DXF;
```

In addition to the building shape (including detach shading elements), the DXF view includes a "true north" arrow and the name from the BUILDING object.

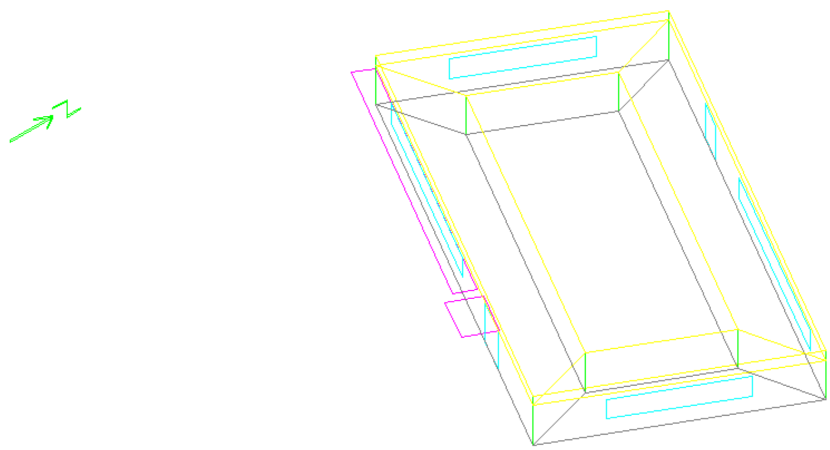

Figure 2. Quick View Plus version of DXF file

Even in the Quick View version, you can see that the different building elements have different colors. Most viewers display roofs as yellow, floors as black, walls as blue, windows as green, shading (attached) as pink, and detached shades as deeper blue. This is shown more definitively in a view from Voloview Express.

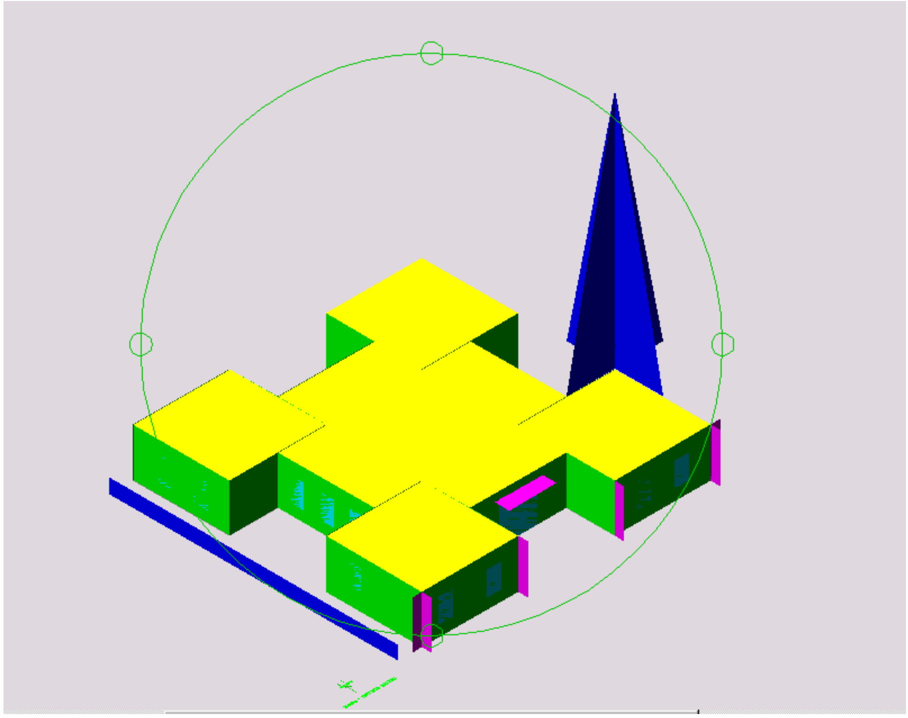

Figure 3. Voloview 3D Solid view

The DXF file of itself is an ASCII file, with a specific structure as specified in the standard. An excerpt of the file is shown below:

```
SECTION
  2
ENTITIES
  0
TEXT
  8
1
  6
CONTINUOUS
 62
  3
 10
      -11.00000
 20
        3.00000
 30
        0.10000
 40
 .25
  1
True North
 41
 0.0
  7
MONOTXT
210
0.0
220
0.0
230
1.0
  0
<reduced for brevity>
```

```
3DFACE
  8
1
 62
  3
 10
     -10.00000
 20
       3.00000
 30
       0.10000
 11
     -10.00000
 21
       3.00000
 31
       0.00000
 12
     -10.00000
 22
       0.00000
 32
       0.00000
 13
     -10.00000
 23
       0.00000
 33
       0.10000
  0
ENDSEC
  0
EOF
999
DXF created from EnergyPlus
999
Program Version,EnergyPlus, Version 1.0.1
```

eplusout.eio

This file contains some standard and some optional "reports". It is intended to be a somewhat intelligent report of input conditions when they don't fit well in other places or when they aren't substantial enough for their own "file". (e.g. **eplusout.bnd**) Contents of the file are somewhat documented in various places in the Input Output Reference document – as results of objects. This file or portions of it can be easily imported into spreadsheet programs and more analysis done there. Contents of this file include construction details, location information, "environment" information, number of "warmup" days required in each environment.

The form of the file is a data dictionary followed by the data. In this case, the data dictionary line precedes the first "data" line though there may be several defining "dictionary lines". Each dictionary line will show the field as <field name> followed by other fields that will be in the data lines. Data will be displayed similarly. Each field of dictionary or data will be separated from the next by a comma "," – and produce a comma delimited file.

> Note that the lines in the eplusout.eio file can be extremely long (current limit is 500 characters).

Simulation Parameters

```
! <Version>, Version ID
 Version, 1.2.0
! <Time Steps per Hour>, #TimeSteps, Minutes per TimeStep
 TimeSteps Per Hour,  4, 15
! <Run Control>, Do Zone Sizing, Do System Sizing, Do Plant Sizing, Do Design Days, Do Weather Simulation
 Run Control, Yes, Yes, No, No, Yes
! <GroundTemperatures>, Months From Jan to Dec {Deg C}
 GroundTemperatures,  20.03,  20.03,  20.13,  20.30,  20.43,  20.52,  20.62,  20.77,  20.78,  20.55,
20.44,  20.20
! <GroundTemperatures:Surface>, Months From Jan to Dec {Deg C}
 GroundTemperatures:Surface,  18.00,  18.00,  18.00,  18.00,  18.00,  18.00,  18.00,  18.00,  18.00,
18.00,  18.00,  18.00
! <GroundTemperatures:Deep>, Months From Jan to Dec {Deg C}
 GroundTemperatures:Deep,  16.00,  16.00,  16.00,  16.00,  16.00,  16.00,  16.00,  16.00,  16.00,  16.00,
16.00,  16.00
! <GroundReflectances>, Months From Jan to Dec {dimensionless}
 GroundReflectances,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20
! <Snow Ground Reflectance Modifiers>, Normal, Daylighting {dimensionless}
 Snow Ground Reflectance Modifiers,   1.000,   1.000
! <Snow GroundReflectances>, Months From Jan to Dec {dimensionless}
 Snow GroundReflectances,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,
0.20
! <Snow GroundReflectances For Daylighting>, Months From Jan to Dec {dimensionless}
 Snow GroundReflectances For Daylighting,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,
0.20,  0.20,  0.20
! <Location>, Location Name, Latitude {N+/S- Deg}, Longitude {E+/W- Deg},  Time Zone Number {GMT+/-},
Elevation {m},  Standard Pressure at Elevation {Pa}
Location,CHICAGO IL USA TMY2-94846 WMO#=725300,41.78,-87.75,-6.00,190.00,99063.
! <Building Information>, Building Name,North Axis {deg},Terrain,  Loads Convergence Tolerance
Value,Temperature Convergence Tolerance Value,  Solar Distribution,Maximum Number of Warmup Days,
Calculate Solar Reflection From Exterior Surfaces
 Building, BUILDING,  30.000,City,   0.04000,   0.40000,FullExterior,25,NO
! Inside Convection Algorithm, Value {Simple | Detailed | CeilingDiffuser | TrombeWall}
Inside Convection Algorithm,Simple
! Outside Convection Algorithm, Value {Simple | Detailed}
Outside Convection Algorithm,Simple
! Solution Algorithm, Value {CTF | EMPD | MTF}
Solution Algorithm, CTF
! Sky Radiance Distribution, Value {Anisotropic}
Sky Radiance Distribution,Anisotropic
! < Input Surface Geometry Information>,Starting Corner,Vertex Input Direction,Coordinate System
 SurfaceGeometry,UpperLeftCorner,CounterClockwise,RelativeCoordinateSystem
```

The simulation parameters output is the simplest form of reporting in the **eplusout.eio** file. Each of the “header” records (lines starting with an “!”) are followed immediately by the one and only data line. By and large, these data lines are all merely echoes of the entries in the IDF (or defaulted for blank fields). For most of these descriptions, you can look at the object fields (of same name) in the Input Output Reference document.

Version

```
! <Version>, Version ID
 Version, 1.2.1
```

This is the version of the IDF as entered in the IDF file. If it does not match the current EnergyPlus Version, a warning will be issued and show in the **eplusout.err** file.

Time Steps Per Hour

```
! <Time Steps per Hour>, #TimeSteps, Minutes per TimeStep
 TimeSteps Per Hour,  4, 15
```

This is the number of time steps in hour as entered in the IDF file as well as showing how many minutes will encompass each time step (i.e. 4 time steps in hour = 15 minutes per time step).

Run Control

```
! <Run Control>, Do Zone Sizing, Do System Sizing, Do Plant Sizing, Do Design Days, Do Weather Simulation
 Run Control, Yes, Yes, Yes, No, Yes
```

This shows how the sizing and running (design days vs. weather file) will be accomplished. Design days are required for sizing but do not necessarily need to be "run" after sizing has completed. Thus, the user can choose to do sizing, not do a "normal" calculation with the design day definitions but then go ahead and run the full simulation year.

Building

```
! <Building Information>, Building Name,North Axis {deg},Terrain,  Loads Convergence Tolerance Value,Temperature Convergence Tolerance Value,  Solar Distribution,Maximum Number of Warmup Days
 Building Information, BUILDING,   30.000,City,    0.04000,    0.40000,FullExterior,25
```

This shows the values put in for the Building Object in the IDF.

Inside Convection Algorithm

```
! <Inside Convection Algorithm>, Value {Simple | Detailed | CeilingDiffuser | TrombeWall}
Inside Convection Algorithm,Simple
```

This shows the inside (interior) convection algorithm selected by the IDF value.

Outside Convection Algorithm

```
! <Outside Convection Algorithm>, Value {Simple | Detailed ! TARP ! MoWitt ! DOE-2 ! BLAST}
Outside Convection Algorithm,Simple
```

This shows the outside (exterior) convection algorithm selected by the IDF value.

Solution Algorithm

```
! <Solution Algorithm>, Value {CTF | EMPD | MTF}
Solution Algorithm, CTF
```

This shows the solution algorithm approach selected by the IDF value.

Sky Radiance Distribution

```
! <Sky Radiance Distribution>, Value {Anisotropic}
Sky Radiance Distribution,Anisotropic
```

This shows the solution algorithm approach used in the simulation. As this value cannot be changed by the user, it is shown for information only.

Shadowing/Sun Position Calculations

```
! <Shadowing/Sun Position Calculations> [Annual Simulations], Value {days}
Shadowing/Sun Position Calculations, 20
```

This shows how many days between the re-calculaton of solar position during a weather file simulation. While a smaller number of days will lead to a more accurate solar position estimation (solar position is important in shadowing as well as determining how much solar enters the space), it also increases the calculation time necessarily to complete the simulation. The default, re-calculating every 20 days, give a good compromise.

AirFlow Model

```
! <AirFlow Model>, Simple/Comis
 AirFlow Model, Simple
```

This shows the air flow method to be used. Note that simply selecting the COMIS model also needs to have the appropriate COMIS input statements to effect the solution. Likewiese, just having the COMIS input statements does not automatically trigger this air flow model. solution algorithm approach selected by the IDF value. In this case, a warning message about "orphan objects" (the COMIS input statements) will appear in the **eplusout.err** file.

Zone Volume Capacitance Multiplier

```
! <Zone Volume Capacitance Multiplier>, Value
Zone Volume Capacitance Multiplier,   1.000
```

This shows the zone volume capacitance multiplier selected by the IDF value.

Surface Geometry

```
! < Input Surface Geometry Information>,Starting Corner,Vertex Input Direction,Coordinate System
 SurfaceGeometry,UpperLeftCorner,CounterClockwise,RelativeCoordinateSystem
```

This shows the expected order of the vertices for each surface.

Climate Group Outputs

Climate related variables appear in two places for EnergyPlus outputs. When the simple (monthly) GroundTemperature input is done and for all location data, lines appear in the eplusout.eio file:

```
! <Location>, Location Name, Latitude {N+/S- Deg}, Longitude {E+/W- Deg},  Time Zone Number {GMT+/-},
Elevation {m},  Standard Pressure at Elevation {Pa}
Location,CHICAGO IL USA TMY2-94846 WMO#=725300,41.78,-87.75,-6.00,190.00,99063.
! <GroundTemperatures>, Months From Jan to Dec {Deg C}
 GroundTemperatures,  20.03,  20.03,  20.13,  20.30,  20.43,  20.52,  20.62,  20.77,  20.78,  20.55,
20.44,  20.20
! <GroundTemperatures:Surface>, Months From Jan to Dec {Deg C}
 GroundTemperatures:Surface,  18.00,  18.00,  18.00,  18.00,  18.00,  18.00,  18.00,  18.00,  18.00,
18.00,  18.00,  18.00
! <GroundTemperatures:Deep>, Months From Jan to Dec {Deg C}
 GroundTemperatures:Deep,  16.00,  16.00,  16.00,  16.00,  16.00,  16.00,  16.00,  16.00,  16.00,  16.00,
16.00,  16.00
! <GroundReflectances>, Months From Jan to Dec {dimensionless}
 GroundReflectances,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20
! <Snow Ground Reflectance Modifiers>, Normal, Daylighting {dimensionless}
 Snow Ground Reflectance Modifiers,   1.000,   1.000
! <Snow GroundReflectances>, Months From Jan to Dec {dimensionless}
 Snow GroundReflectances,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,
0.20
! <Snow GroundReflectances For Daylighting>, Months From Jan to Dec {dimensionless}
 Snow GroundReflectances For Daylighting,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,  0.20,
0.20,  0.20,  0.20
```

In addition for each “environment” simulated, information about the environment is shown:

```
! <Environment>,Environment Name,Environment Type, Start Date, End Date, Start DayOfWeek, Duration
{#days}, Source:Start DayOfWeek,  Use Daylight Savings, Use Holidays, Apply Weekend Holiday Rule
! <Environment:Special Days>, Special Day Name, Special Day Type, Source, Start Date, Duration {#days}
! <Environment:Daylight Saving>, Daylight Saving Indicator, Source, Start Date, End Date
! <Environment:Design_Day_Misc>,DayOfYear,ASHRAE A Coeff,ASHRAE B Coeff,ASHRAE C Coeff,Solar Constant-
Annual Variation,Eq of Time {minutes}, Solar Declination Angle {deg}
! <Environment:WarmupDays>, NumberofWarmupDays
```

For example, a DesignDay:

```
Environment,PHOENIX ARIZONA WINTER,DesignDay, 1/21, 1/21,MONDAY,  1,N/A,N/A,N/A,N/A
Environment:Daylight Saving,No,DesignDay
Environment:Design_Day_Misc, 21,1228.9,0.1414,5.7310E-002,1.0,-11.14,-20.0
```

Or a RunPeriod:

```
Environment,CHICAGO IL TMY2-94846 WMO#=725300,WeatherRunPeriod, 1/
1,12/31,SUNDAY,365,UseWeatherFile,Yes,Yes,No
Environment:Daylight Saving,No,
Environment:Special Days,NEW YEARS DAY,Holiday,WeatherFile, 1/ 1,  1
Environment:Special Days,MEMORIAL DAY,Holiday,WeatherFile, 5/31,  1
Environment:Special Days,INDEPENDENCE DAY,Holiday,WeatherFile, 7/ 5,  1
Environment:Special Days,LABOR DAY,Holiday,WeatherFile, 9/ 6,  1
Environment:Special Days,THANKSGIVING,Holiday,WeatherFile,11/25,  1
Environment:Special Days,CHRISTMAS,Holiday,WeatherFile,12/25,  1
Environment:WarmupDays,  4
```

Note that in this display, using "weekend rule" and specific date holidays, the actual observed dates are shown in the output display – in the example above, Independence Day (July 4) is actually observed on July 5.

Climate Group – Simple Outputs

Some of the climate outputs are a "simple" group. The "header" line is followed immediately by the data line.

Location

This output represents the location data used for the simulation. Note that if a runperiod is used, the IDF "Location" is ignored and the location from the weather file is used instead.

Field: <Location>

This data field will contain the constant "Location".

Field: Location Name

This is the name given to the location whether from the IDF or the weather file.

Field: Latitude

This is the latitude of the site, expressed decimally. Convention uses positive (+) values for North of the Equator and negative (-) values for South of the Equator. For example, S 30° 15' is expressed as –30.25.

Field: Longitude

This is the longitude of the site, expressed decimally. Convention uses positive (+) values for East of the Greenwich meridian and negative (-) values for West of the Greenwich meridian. For example, E 130° 45' is expressed as +130.75.

Field: Time Zone Number

This is the time zone of the site, expressed decimally. Convention uses positive (+) values for GMT+ (Longitude East of the Greenwich meridian) and negative (-) values for GMT- (Longitude West of the Greenwich meridian). For example, the time zone for Central US time is –6. The time zone for parts of Newfoundland is –3.5 (-3 hours, 30 minutes from GMT).

Field: Elevation {m}

This is the elevation of the site. Units are m.

Ground Temperatures and Ground Temperatures:Deep and Ground Temperatures: Surface

Field: <GroundTemperatures>

This data field will contain the constant "GroundTemperatures".

Field Set (1-12) – Monthly Ground Temperatures

There will be a set of 12 numbers – the ground temperatures by month: January, February, March, April, May, June, July, August, September, October, November, December. Units are C.

Ground Reflectance

Field: <GroundReflectances>

This data field will contain the constant "GroundReflectances".

Field Set (1-12) – Monthly Ground Reflectances

There will be a set of 12 numbers – the ground reflectances by month: January, February, March, April, May, June, July, August, September, October, November, December.

Snow Ground Reflectance Modifiers

It is generally accepted that snow resident on the ground increases the basic ground reflectance. EnergyPlus allows the user control over the snow ground reflectance for both "normal ground reflected solar" calculations (see above) and snow ground reflected solar modified for daylighting. This is the display of the user entered or defaulted values.

Field: <Snow Ground Reflectance Modifiers>

This data field will contain the constant "Snow Ground Reflectance Modifiers".

Field: Normal

This field is the value between 0.0 and 1.0 which is used to modified the basic monthly ground reflectance when snow is on the ground (from design day input or weather data values).

$$\mathrm{GroundReflectance}_{\mathrm{used}} = \mathrm{GroundReflectance} \bullet Modifier_{Snow}$$

Field: Daylighting

This field is the value between 0.0 and 1.0 which is used to modified the basic monthly ground reflectance when snow is on the ground (from design day input or weather data values).

$$\mathrm{DaylightingGroundReflectance}_{\mathrm{used}} = \mathrm{GroundReflectance} \bullet Modifier_{Snow}$$

Snow Ground Reflectance

This data is the result of using the Snow Ground Reflectance modifier and the basic Ground Reflectance value.

Field: <GroundReflectances>

This data field will contain the constant “Snow GroundReflectances”.

Field Set (1-12) – Monthly Snow Ground Reflectances

There will be a set of 12 numbers – the snow ground reflectances by month: January, February, March, April, May, June, July, August, September, October, November, December.

Snow Ground Reflectance for Daylighting

This data is the result of using the Snow Ground Reflectance for Daylighting modifier and the basic Ground Reflectance value.

Field: < Snow GroundReflectances For Daylighting>

This data field will contain the constant “Snow GroundReflectances For Daylighting”.

Field Set (1-12) – Monthly Snow Ground Reflectances for Daylighting

There will be a set of 12 numbers – the ground reflectances by month: January, February, March, April, May, June, July, August, September, October, November, December.

Climate Group – Not so Simple Outputs

For each “environment” simulated, a set of outputs is produced. The header group is only produced once. (The Design Day Misc header is produced only when there is a design day.)

```
! <Environment>,Environment Name,Environment Type, Start Date, End Date, Start DayOfWeek, Duration
{#days}, Source:Start DayOfWeek,  Use Daylight Saving, Use Holidays, Apply Weekend Holiday Rule
! <Environment:Special Days>, Special Day Name, Special Day Type, Source, Start Date, Duration {#days}
! <Environment:Daylight Saving>, Daylight Saving Indicator, Source, Start Date, End Date
! <Environment:Design_Day_Misc>,DayOfYear,ASHRAE A Coeff,ASHRAE B Coeff,ASHRAE C Coeff,Solar Constant-
Annual Variation,Eq of Time {minutes}, Solar Declination Angle {deg}
! <Environment:WarmupDays>, NumberofWarmupDays
```

Environment Line

Each “environment” (i.e. each design day, each run period) will have this line shown.

Field: <Environment>

This field will have the constant “Environment” in each data line.

Field:Environment Name

This field will have the “name” of the environment. For example, the design day name (“DENVER COLORADO SUMMER”) or the weather file location name (“BOULDER CO TMY2-94018 WMO#=724699”).

Field:Environment Type

This will be “DesignDay” for design day simulations and “WeatherRunPeriod” for weather file run periods.

Field: Start Date

This will have the month/day that is the starting date for the simulation period. (7/21, for example).

Field: End Date

This will have the month/day that is the ending date for the simulation period. Note that Design Days are only one day and the end date will be the same as the start date.

Field: Start DayOfWeek

For weather periods, this will be the designated starting day of week. For design days, it will be the day type listed for the design day object (e.g. SummerDesignDay or Monday).

Field: Duration {#days}

Number of days in the simulation period will be displayed in this field. Design days are only 1 day.

Field: Source:Start DayOfWeek

This field will list the "source" of the Start Day of Week listed earlier. This could be the RunPeriod command from the input file or the Weather File if the UseWeatherFile option was chosen in the RunPeriod command. For design days, this will be "N/A".

Field: Use Daylight Saving

This field reflects the value of the Use Daylight Saving field of the RunPeriod object. For design days, this will be "N/A".

Field: Use Holidays

This field reflects the value of the Use Holidays field of the RunPeriod object. For design days, this will be "N/A".

Field: Apply Weekend Holiday Rule

For design days, this will show "N/A". For weather periods, this will show "Yes" if the Apply Weekend Holiday Rule is in effect or "No" if it isn't.

Design Day Misc Line

This line is shown for each design day simulated. It is not shown for sizing runs that do not subsequently use the design day as a simulation period.

Field: <Design Day Misc>

This is a constant that will display "Environment:Design_Day_Misc".

Field:DayOfYear

This is the Julian day of year for the design day (i.e. Jan 1 is 1, Jan 31 is 31).

Field:ASHRAE A Coeff

Reference ASHRAE HOF 30 – this is the A Coefficient in Wh/m^2 calculated from EnergyPlus.

Field:ASHRAE B Coeff

Likewise, this is the ASHRAE B Coefficient (dimensionless).

Field:ASHRAE C Coeff

This is the ASHRAE C Coefficient (dimensionless).

Field:Solar Constant-Annual Variation

This is the calculated solar constant using the given location and day of year.

Field:Eq of Time {minutes}

This is the calculated equation of time (minutes) using the given location and day of year.

Field: Solar Declination Angle {deg}

This is the solar declination angle for the day of year, degrees.

Special Day Line

Field: <Environment:Special Days>

This is a constant that will display “Environment:SpecialDays”.

Field: Special Day Name

This is the user designated name for the special day.

Field: Special Day Type

This shows the type for the special day (e.g. Holiday).

Field: Source

This will display “InputFile” if it was specified in the IDF or “WeatherFile” if it came from the weather file designation.

Field: Start Date

This shows the starting date as month/day (e.g. 7/4).

Field: Duration {#days}

This shows how many days the special day period continues. Usually, holidays are only 1 day duration.

Daylight Saving Line

Field: <Environment:Daylight Saving>

This is a constant that will display “Environment:DaylightSaving”.

Field: Daylight Saving Indicator

This will be Yes if daylight saving is to be observed for this simulation period and No if it is not observed.

Field: Source

This will show the source of this invocation (or non-invocation). Inputfile if DaylightSavingPeriod was entered (weather files only), WeatherFile if used in the Weather file and selected in the Run Period object and designday if that was the source.

Field: Start Date

If the indicator field is Yes, then this field will be displayed and the month/day (e.g. 4/1) that starts the daylight saving period observance will be shown.

Field: End Date

If the indicator field is Yes, then this field will be displayed and the month/day (e.g. 10/29) that ends the daylight saving period observance will be shown.

Warmup Days Line

As described elsewhere, EnergyPlus simulates the first day of each simulation period until it reaches "convergence". This data line will show how many warm up days were required to reach that state.

Field: <Environment:WarmupDays>

This is a constant that will display "Environment:WarmupDays".

Field: NumberofWarmupDays

This field will show the number of days required to reach the convergence state for the simulation.

Zone Outputs

Each zone is summarized in a simple set of statements as shown below:

```
! <Zone Information>,Zone Name,North Axis {deg},X Origin {m},Y Origin {m},Z Origin {m},Type,Multiplier,
Ceiling Height {m},Volume {m3},Zone Inside Convection Algorithm {Simple-Detailed-CeilingDiffuser-
TrombeWall}, Floor Area {m2},Exterior Gross Wall Area {m2},Exterior Net Wall Area {m2},Exterior Window
Area {m2}
 Zone, PSI FOYER,   0.000,   0.000,   0.000,   0.000,   1,   1,   4.953,   478.555,Detailed,    96.619,
70.606,    70.606,   106.838
 Zone, DORM ROOMS AND COMMON AREAS,   0.000,   0.000,   6.096,   0.000,   1,   1,   6.096,
2718.417,Detailed,   445.935,   312.154,   267.561,    44.593
 Zone, LEFT FORK, -36.870,   0.000,  31.699,   0.000,   1,   1,   6.096,   453.070,Detailed,    74.322,
185.806,   135.638,    50.168
 Zone, MIDDLE FORK,   0.000,   4.877,  35.357,   0.000,   1,   1,   6.096,   453.070,Detailed,    74.322,
185.806,   155.705,    30.101
 Zone, RIGHT FORK,  36.870,  10.973,  35.357,   0.000,   1,   1,   6.096,   453.070,Detailed,    74.322,
185.806,   135.638,    50.168
```

Field: <Zone Information>

This field contains the constant "Zone" for each line.

Field: Zone Name

This is the Zone Name entered from the IDF.

Field: North Axis {deg}

This is the North Axis entered from the IDF. Note that this is used primarily in the positioning of the building when "relative" coordinates are used – however, the Daylighting:Detailed object also uses this. Units are degrees, clockwise from North.

Fields: X Origin {m}, Y Origin {m}, Z Origin {m}

This is the origin vertex {X,Y,Z} entered from the IDF. Note that this is used primarily in the positioning of the building when "relative" coordinates are used – however, the Daylighting:Detailed object also uses this. Units are m.

Field: TypeField: Multiplier

This is the multiplier (must be integral) entered from the IDF.

Field: Ceiling Height {m}

This is the ceiling height entered, if any, in the IDF. Ceiling height is also heuristically calculated from the surfaces in the zone – however, not all surfaces need to be entered and sometimes the user would rather enter the ceiling height for the zone. If no ceiling height was entered (i.e. the default of 0), this field will be the calculated value. A minor warning message will be issued if the calculated value is significantly different than the entered value. Units are m.

Field: Volume {m3}

Like the ceiling height, this user can also enter this value in the IDF. Volume is also heuristically calculated using the ceiling height (entered or calculated) as well as the calculated floor area (see later field). If entered here, this value will be used rather than the calculated value. A minor warning message will be issued if the calculated value is significantly different than the entered value. Units are m^3.

Field: Zone Inside Convection Algorithm {Simple-Detailed-CeilingDiffuser-TrombeWall}

The interior convection algorithm shown earlier (entire building) can be overridden for each zone by an entry in the individual Zone object. This field will show which method is operational for the zone.

Field: Floor Area {m2}

This field is calculated from the floor surfaces entered for the zone. Units are m^2.

Field: Exterior Gross Wall Area {m2}

This field is calculated from the exterior wall surfaces entered for the zone. Units are m^2.

Field: Exterior Net Wall Area {m2}

This field is calculated from the exterior wall surfaces entered for the zone. Any sub-surface area is subtracted from the gross area to determine the net area. Units are m^2.

Field: Exterior Window Area {m2}

This field is calculated from the exterior window surfaces entered for the zone. Units are m^2.

Surface Details Report

A good example of this is the surface details report (**Report, Surfaces, Details;**, **Report, Surfaces, Vertices;**, **Report, Surfaces, DetailsWithVertices;**). Excerpt from the file:

```
Line 1: ! <Zone/Shading Surfaces>,<Zone Name>/#Shading Surfaces,# Surfaces, Vertices are shown starting at Upper-Left-Corner => Counter-Clockwise => World Coordinates
Line 2: ! <HeatTransfer/ShadingSurface>,<Surface Name>,<Surface Class>,<Base Surface>,<Construction>,Nominal U (w/o film coef),Area (Net),Azimuth,Tilt,~Width,~Height,Reveal,<ExtBoundCondition>,<SunExposure>,<WindExposure>,ViewFactorToGround,ViewFactorToSky,ViewFactorToGround-IR,ViewFactorToSky-IR,#Sides,{Vertex 1},,,{Vertex 2},,,{Vertex 3},,,{Vertex 4},,,{etc}
Line 3: ! <Units>,,,,,{W/m2-K},{m2},{deg},{deg},{m},{m},{m},,,,,,,,,X {m},Y {m},Z {m},X {m},Y {m},Z {m},X {m},Y {m},Z {m},X {m},Y {m},Z {m}
Ex Line 1: Shading_Surfaces,Number of Shading Surfaces,   10
Ex Line 2: Shading_Surface,WEST SIDE BUSHES,DETACHED,,,,          180.00000, 90.0, 90.0,     60.00,
3.00,,,,,,,,, 4,     -5.00,       0.00,       3.00,      -5.00,       0.00,       0.00,      -5.00,      60.00,
0.00,     -5.00,      60.00,       3.00
Ex Line 2: Shading_Surface,EAST SIDE TREE1,DETACHED,,,,          500.00000,270.0, 90.0,     20.00,
50.99,,,,,,,,, 3,      70.00,      30.00,      50.00,      70.00,      40.00,       0.00,      70.00,      20.00,
0.00
Ex Line 2: Shading_Surface,EAST SIDE TREE2,DETACHED,,,,          500.00000,  0.0, 90.0,     20.00,
50.99,,,,,,,,, 3,      70.00,      30.00,      50.00,      80.00,      30.00,       0.00,      60.00,      30.00,
0.00
Ex Line 1: Zone_Surfaces,HEARTLAND AREA,   35
Ex Line 2: HeatTransfer_Surface,ZN001:WALL001,WALL,,EXTERIOR,   0.64,           136.00000,180.0, 90.0,
20.00,      10.00,  0.00,ExternalEnvironment,SunExposed,WindExposed,  0.50,  0.50,  0.50,  0.50, 4,
20.00,      10.00,      10.00,      20.00,      10.00,       0.00,      40.00,      10.00,       0.00,      40.00,
10.00,      10.00
Ex Line 2: HeatTransfer_Surface,ZN001:WALL001:WIN001,WINDOW,ZN001:WALL001,SINGLE PANE HW WINDOW,   6.12,
64.00000,180.0, 90.0,       8.00,       8.00,  0.00,ExternalEnvironment,SunExposed,WindExposed,  0.50,
0.50,  0.50,  0.50, 4,      26.00,      10.00,       8.10,      26.00,      10.00,       0.10,      34.00,
10.00,       0.10,      34.00,      10.00,       8.10
Ex Line 2: HeatTransfer_Surface,ZN001:WALL002,WALL,,EXTERIOR,   0.64,           155.00000, 90.0, 90.0,
20.00,      10.00,  0.00,ExternalEnvironment,SunExposed,WindExposed,  0.50,  0.50,  0.50,  0.50, 4,
50.00,      20.00,      10.00,      50.00,      20.00,       0.00,      50.00,      40.00,       0.00,      50.00,
40.00,      10.00
Ex Line 2: HeatTransfer_Surface,ZN001:WALL002:WIN001,WINDOW,ZN001:WALL002,SINGLE PANE HW WINDOW,   6.12,
15.00000, 90.0, 90.0,       3.00,       5.00,  0.00,ExternalEnvironment,SunExposed,WindExposed,  0.50,
0.50,  0.50,  0.50, 4,      50.00,      22.20,       7.30,      50.00,      22.20,       2.30,      50.00,
25.20,       2.30,      50.00,      25.20,       7.30
Ex Line 2: HeatTransfer_Surface,ZN001:WALL002:WIN002,WINDOW,ZN001:WALL002,SINGLE PANE HW WINDOW,   6.12,
15.00000, 90.0, 90.0,       3.00,       5.00,  0.00,ExternalEnvironment,SunExposed,WindExposed,  0.50,
0.50,  0.50,  0.50, 4,      50.00,      28.50,       7.30,      50.00,      28.50,       2.30,      50.00,
31.50,       2.30,      50.00,      31.50,       7.30
Ex Line 2: HeatTransfer_Surface,ZN001:WALL002:WIN003,WINDOW,ZN001:WALL002,SINGLE PANE HW WINDOW,   6.12,
15.00000, 90.0, 90.0,       3.00,       5.00,  0.00,ExternalEnvironment,SunExposed,WindExposed,  0.50,
0.50,  0.50,  0.50, 4,      50.00,      35.30,       7.30,      50.00,      35.30,       2.30,      50.00,
38.30,       2.30,      50.00,      38.30,       7.30
<reduced for brevity>
```

```
Ex Line 1: Zone_Surfaces,MAINE WING,   12
Ex Line 2: HeatTransfer_Surface,ZN005:WALL001,WALL,,EXTERIOR,   0.64,           100.00000,180.0, 90.0,
10.00,      10.00,  0.00,ExternalEnvironment,SunExposed,WindExposed,  0.50,  0.50,  0.50,  0.50, 4,
50.00,      40.00,      10.00,      50.00,      40.00,       0.00,      60.00,      40.00,       0.00,      60.00,
40.00,      10.00
Ex Line 2: HeatTransfer_Surface,ZN005:WALL002,WALL,,EXTERIOR,   0.64,           170.00000, 90.0, 90.0,
20.00,      10.00,  0.00,ExternalEnvironment,SunExposed,WindExposed,  0.50,  0.50,  0.50,  0.50, 4,
60.00,      40.00,      10.00,      60.00,      40.00,       0.00,      60.00,      60.00,       0.00,      60.00,
60.00,      10.00
Ex Line 2: HeatTransfer_Surface,ZN005:WALL002:WIN001,WINDOW,ZN005:WALL002,SINGLE PANE HW WINDOW,   6.12,
15.00000, 90.0, 90.0,       3.00,       5.00,  0.00,ExternalEnvironment,SunExposed,WindExposed,  0.50,
0.50,  0.50,  0.50, 4,      60.00,      44.30,       7.50,      60.00,      44.30,       2.50,      60.00,
47.30,       2.50,      60.00,      47.30,       7.50
```

Description of the Detailed Surfaces Report(s)

The preceding excerpt includes the surface details *and* vertices. You can also obtain the report with *just* the details or *just* the vertices.

```
Line 1: ! <Zone/Shading Surfaces>,<Zone Name>/#Shading Surfaces,# Surfaces, Vertices are shown starting at Upper-Left-Corner => Counter-Clockwise => World Coordinates
```

When a line is shown with the comment character (!) in the first position, it signifies a informational "header" record for the report. In addition, "Line 1" is also a header for the subsequent "real" surface lines.

Field: <Zone/Shading Surfaces>

This field is a dual purpose field. For beginning of the Shading Surfaces, it will show "Shading_Surfaces". At each Zone, it will show "Zone_Surfaces".

Field: <Zone Name>/#Shading Surfaces

This field is a dual purpose field. It will either show the Zone Name of the subsequent surfaces or the "Number of Shading Surfaces" for the entire building.

Field: # Surfaces

This field, then, specifies the number of surfaces of the type (zone or shading) that will follow.

The example lines illustrate:

```
Shading_Surfaces,Number of Shading Surfaces,   10
Zone_Surfaces,HEARTLAND AREA,   35
Zone_Surfaces,MAINE WING,   12
```

```
Line 2: ! <HeatTransfer/ShadingSurface>,<Surface Name>,<Surface Class>,<Base Surface>,<Construction>,Nominal U (w/o film coef),Area (Net),Azimuth,Tilt,~Width,~Height,Reveal,<ExtBoundCondition>,<SunExposure>,<WindExposure>,ViewFactorToGround,ViewFactorToSky,ViewFactorToGround-IR,ViewFactorToSky-IR,#Sides,{Vertex 1},,,{Vertex 2},,,{Vertex 3},,,{Vertex 4},,,{etc}
Line 3: ! <Units>,,,,,{W/m2-K},{m2},{deg},{deg},{m},{m},{m},,,,,,,,,X {m},Y {m},Z {m},X {m},Y {m},Z {m},X {m},Y {m},Z {m},X {m},Y {m},Z {m}
```

Line 2 shows the full detail of each surface record with Line 3 used for illustrating the units of individual fields (as appropriate).

The first four fields (<HeatTransfer/ShadingSurface>,Surface Name, Surface Class, Base Surface) are included in all the Surface reports (Details, Vertices, Details with Vertices).

Field: <HeatTransfer/ShadingSurface>

For shading surfaces, this will be a constant "Shading_Surface". For heat transfer surfaces, this will be a constant "HeatTransfer_Surface".

Field: Surface Name

This field will contain the actual surface name as entered in the IDF.

Field: Surface Class

This field contains the surface class (e.g. Window, Door, Wall, Roof) as entered in the IDF.

Field: Base Surface

This field contains the base surface name if this surface is a sub-surface (i.e. Window, Door).

Fields in Details and Details with Vertices report.

Field: Construction

This field will contain the name of the construction used for the surface. (Will be empty for shading surfaces).

Field: Nominal U (w/o film coef)

A nominal thermal conductance for the surface is calculated for the surface. It does not include interior or exterior film coefficients as this is calculated during the simulation and is dependent on several factors that may change during the simulation time period. Units for this field are W/m^2-K.

Field: Area (net)

When surfaces are entered, the gross area of the surface is calculated from the vertices (except for Internal Mass where it is entered directly). As net area is needed in the calculations, any sub-surfaces to the primary surface are subtracted from the original gross area. This field will show the final "net" area for the surface. Units for this field are m^2.

Field: Azimuth

Using the specified vertices for the surface (and order of entry), EnergyPlus can determine the outward facing normal angle for the surface. That angle is displayed in this field. Units for this field are degrees.

Field: Tilt

Using the specified vertices for the surface (and order of entry), EnergyPlus can determine the tilt of the surface with respect to "horizontal". That angle is displayed in this field. Units for this field are degrees.

Field: ~Width

This field (approximate width of the surface) is calculated and filled by EnergyPlus from the entered vertices. Some parts of EnregyPlus use a width and height rather than the more detailed vertex/area calculations. Units for this field are m.

Field: ~Height

This field (approximate height of the surface) is calculated and filled by EnergyPlus from the entered vertices. Some parts of EnregyPlus use a width and height rather than the more detailed vertex/area calculations. Units for this field are m.

Field: Reveal

This field is calculated for sub-surfaces with respect to their base surfaces using the entered vertices, plane of the two surfaces, and distance between the planes. Reveal may be important in shading of windows, in particular. Units for this field are m.

Field: <ExtBoundCondition>

This field shows the exterior boundary condition for the surface. If this is a surface that is "external" the values will be **ExternalEnvironment** or **Ground**. If this surface is an interzone surface, this value will be the surface name in the "other" zone. If this surface is an internal surface, this value will be the same as the surface name. If this is a special surface with "Other Side Coefficients", the value will be **OtherSideCoefficients**.

Field: <SunExposure>

The value for this field will be **SunExposed** or **NoSun**. Internal surfaces should have NoSun exposure.

Field: <WindExposure>

The value for this field will be **WindExposed** or **NoWind**. Internal surfaces should have NoWind exposure.

Field: ViewFactorToGround

This value has been entered as part of the surface description. View factor to ground is described in the Input Output Reference document during the Surface:HeatTransfer description.

Field: ViewFactorToSky

This value is calculated by EnergyPlus based on surface tilt and shadowing surfaces.

Field: ViewFactorToGround-IR

This value is calculated by EnergyPlus based on surface tilt and shadowing surfaces. Shadowing surfaces are considered to have the same emissivity and temperature as the ground, so they are lumped together with the ground in calculating the ground IR view factor.

Field: ViewFactorToSky-IR

This value is calculated by EnergyPlus based on surface tilt and shadowing surfaces.

Field: #Sides

This value is the number of sides / vertices the surface has.

Fields in Vertices Reports

Field Set: Vertex x [X {m}, Y {m}, Z {m}]

For each side of the surface, the vertices are shown in three separate fields (comma separated) in the EnergyPlus “standard” coordinate order (Upper Left Corner first, Counter-Clockwise, World Coordinates). Units for each vertex is m.

Calculating with Surface Details Report

It is reasonably easy to import this data into a spreadsheet and then calculate glazing area percentage based on wall facing direction:

<Zone Name>	# Surfaces			
<Surface Name>	<Surface Class>	Nominal U (w/o film coef)	Area (Net)	Azimuth
		{W/m2-K}	{m2}	{deg}
HEARTLAND AREA	**35**			
ZN001:WALL001	WALL	0.64	136	180
ZN001:WALL001:WIN001	WINDOW	6.12	64	180
South Window/Wall			**32%**	
ZN001:WALL002	WALL	0.64	155	90
ZN001:WALL002:WIN001	WINDOW	6.12	15	90
ZN001:WALL002:WIN002	WINDOW	6.12	15	90
ZN001:WALL002:WIN003	WINDOW	6.12	15	90
East Window/Wall			**23%**	
ZN001:WALL003	WALL	0.64	155	0
ZN001:WALL003:WIN001	WINDOW	6.12	15	0
ZN001:WALL003:WIN002	WINDOW	6.12	15	0
ZN001:WALL003:WIN003	WINDOW	6.12	15	0
North Window/Wall			**23%**	
ZN001:WALL004	WALL	0.64	155	270
ZN001:WALL004:WIN001	WINDOW	6.12	15	270
ZN001:WALL004:WIN002	WINDOW	6.12	15	270
ZN001:WALL004:WIN003	WINDOW	6.12	15	270
West Window/Wall			**23%**	

Figure 4. Surface Details with Window/Wall % calculated

Construction Element Outputs

An optional report (contained in **eplusout.eio**) gives calculated elements for the materials and constructions used in the input. One report is specific to opaque constructions (note that nominal thermal conductance is calculated).

The report is invoked by including the following in the IDF:

```
Report,Construction;
```

```
Line 1: ! <Construction>,Construction Name,#Layers,#CTFs,Time Step {hours},ThermalConductance {w/m2-K},OuterThermalAbsorptance,InnerThermalAbsorptance,OuterSolarAbsorptance,InnerSolarAbsorptance,Roughness
Line 2: ! <Material>,Material Name,Thickness {m},Conductivity {w/m-K},Density {kg/m3},Specific Heat {J/kg-K},ThermalResistance {m2-K/w}
Line 2: ! <Material:Air>,Material Name,ThermalResistance {m2-K/w}
Line 3: ! <CTF>,Time,Outside,Cross,Inside,Flux (except final one)
Ex Line 1: Construction,EXTWALL09, 4,10, 0.250,2.545    ,   0.900,   0.900,   0.930,   0.920,Rough
Ex Line 2: Material,A2 - 4 IN DENSE FACE BRICK,  0.1015, 1.245, 2082.400, 920.480,  0.8151E-01
Ex Line 2: Material:Air,B1 - AIRSPACE RESISTANCE,  0.1604
Ex Line 2: Material,C3 - 4 IN HW CONCRETE BLOCK,  0.1015, 0.813,  977.126,  836.800,  0.1249
Ex Line 2: Material,E1 - 3 / 4 IN PLASTER OR GYP BOARD,0.0191,0.726, 1601.846,  836.800,  0.2622E-01
Ex Line 3: CTF,  10,     0.13890138E-11,     0.95367648E-14,     0.62566281E-10,    -0.39500133E-14
Ex Line 3: CTF,   9,    -0.32803336E-08,     0.29933755E-10,    -0.60855613E-07,     0.10196216E-10
Ex Line 3: CTF,   8,     0.23798948E-05,     0.21201413E-07,     0.21649376E-04,    -0.88463084E-08
Ex Line 3: CTF,   7,    -0.58681847E-03,     0.38118098E-05,    -0.26539198E-02,     0.25879187E-05
Ex Line 3: CTF,   6,     0.46201324E-01,     0.18871269E-03,     0.12095720    ,    -0.26290432E-03
Ex Line 3: CTF,   5,     -1.2828328    ,     0.27337395E-02,     -2.1646103    ,     0.91268499E-02
Ex Line 3: CTF,   4,      13.603723    ,     0.11920108E-01,      17.065325    ,    -0.12663354
Ex Line 3: CTF,   3,     -62.546625    ,     0.15112689E-01,     -64.276824    ,     0.73877389
Ex Line 3: CTF,   2,      133.27916    ,     0.47414487E-02,      120.00640    ,     -1.9706501
Ex Line 3: CTF,   1,     -130.02410    ,     0.22383019E-03,     -106.88260    ,      2.3359193
Ex Line 3: CTF,   0,      46.959981    ,     0.53137072E-06,      36.168919
```

Description of the Opaque Construction Report

The Opaque Construction report has 3 parts for each construction.

Part 1 is the construction name along with some derived values for the entire construction (i.e. Thermal Conductance) as well as noting other details about the surface (# CTFs, # Layers).

Part 2 shows the material layers for the construction. This is essentially just an echo of the entered properties of the materials from the IDF.

Part 3 shows the CTFs as calculated for the Construction. CTFs are described more completely in the Engineering Reference document.

Fields in Part 1 – Opaque Construction Report

Field: <Construction>

This will be filled with the constant “Construction” for each Construction line.

Field: Construction Name

This is the name of the construction as entered in the IDF.

Field: #Layers

This is the number of material layers inferred from the construction entry in the IDF. Material layers are listed “outside” to “inside” of the construction. This, of course, depends on the placement of the surface in the building – the “outside” of an internal surface is the layer that is closest to whatever the surface touches whereas the “inside” of an internal surface is the layer that shows in the surface’s “zone”. The outside of an external surface is the layer that faces the outside environment and, again, the inside is the layer that shows in the zone.

Field: #CTFs

This is the calculated number of CTFs (Conduction Transfer Functions). The conduction transfer functions are temperature and flux coefficients that characterize the thermal properties of the wall.

Field: Time Step

The "time step" in the construction line is the time step at which the CTFs are valid. Because CTFs for certain constructions might not be stable at the user specified time step (might be too "heavy" from a thermal mass standpoint), this may be different from the zone time step (specified in “TimeStep in Hour”). In all cases though, this will be greater than or equal to the zone time step. If the time step for the construction is greater than the zone time step, E+ will use interpolated histories to solve for the surface heat balances for this surface (see discussion on interpolated histories in the Engineering Reference document).

Field: Thermal Conductance

This is the nominal thermal conductance of the construction calculated without film coefficients. Units are w/m^2-K.

Field: Outer Thermal Absorptance

This will be the thermal absorptance of the outer material layer.

Field: Inner Thermal Absorptance

This will be the thermal absorptance of the inner material layer.

Field: Outer Solar Absorptance

This will be the solar absorptance of the outer material layer.

Field: Inner Solar Absorptance

This will be the solar absorptance of the inner material layer.

Field: Roughness

The construction takes on the roughness from the outer material layer. Roughness is used in several parts of external environment calculations.

Fields in Part 2 – Opaque Construction Report

```
Line 2: ! <Material>,Material Name,Thickness {m},Conductivity {w/m-K},Density {kg/m3},Specific Heat {J/kg-K},ThermalResistance {m2-K/w}
```

In this version of part 2, the full material properties are entered by the user and displayed in the report.

Field: <Material>

This will be filled with the constant “Material” for each material layer line.

Field: Material Name

This is the name of the material as entered in the IDF.

Field: Thickness

This is the entered thickness of the material. Units are m.

Field: Conductivity

For Material:Regular materials, this will be the entered conductivity in w/m-K. For Material:Regular-R materials, this will be shown as 0.0.

Field: Density

For Material:Regular materials, this will be the entered density in kg/m^3. For Material:Regular-R materials, this will be shown as 0.0.

Field: Specific Heat

For Material:Regular materials, this will be the entered specific heat in J/kg-K. For Material:Regular-R materials, this will be shown as 0.0.

Field: Thermal Resistance

For Material:Regular-R materials, this is the entered thermal resistance in m^2-K/w. For Material:Regular materials, this is the calculated thermal resistance based on the other properties.

```
Line 3: ! <Material:Air>,Material Name,ThermalResistance {m2-K/w}
```

In this version of part 2, only the thermal resistance of the air layer is entered by the user and displayed in the report.

Field: <Material:Air>

This will be filled with the constant “Material:Air” for each material layer line.

Field: Material Name

This is the name of the material as entered in the IDF.

Field: Thermal Resistance

This is the entered thermal resistance in m^2-K/w.

Fields in Part 3 – Opaque Construction Report

```
Line 4: ! <CTF>,Time,Outside,Cross,Inside,Flux (except final one)
```

In part 3, the CTF calculations are shown. It is necessary to use the conduction transfer functions labeled "Inside" and "Cross" to calculate the heat flux at the inside surface and the conduction transfer functions labeled "Outside" and "Cross" to calculate the heat flux at the outside surface. Inside and outside coefficients will be identical for symmetric walls.

Conduction through constructions such as walls, roofs, floors, etc. is generally characterized as one-dimensional and transient within EnergyPlus. The solution to this partial differential equation results in "conduction transfer functions" or CTFs. In a CTF equation, the current heat transfer flux due to conduction through a construction is a function of the current temperature at either face of the surface as well as the history of temperatures at either face and the history of conductive fluxes at this face. CTFs are a simplification of response factors which are based solely on temperature histories and require an "infinite" history. The inclusion of heat flux history terms reduces the overall number of terms in the equation for conductive flux significantly, resulting in a more efficient solution.

For each unique combination of materials, there are a unique set of CTFs. While there are other procedures to determine the CTFs for a particular construction, EnergyPlus uses a state-space method (see conduction transfer function documentation) to obtain the CTF coefficients. These coefficients are calculated once at the beginning of the simulation and are constant for a particular construction. The CTF equation itself is a linear equation with these constant coefficients.

Conduction heat transfer flux at the outside face of a particular surface is a function of the construction of the surface (which leads to the CTF coefficients), the current and previous temperatures at both the inside and outside face of the surface, and the previous conduction heat transfer fluxes at the outside surface. The CTF coefficients that would be used in this equation would be the "Outside" (multiplied by the temperature history at the outside face) terms, the "Cross" (multiplied by the temperature history at the inside face) terms, and the "Flux" (multiplied by the flux history at the outside face) terms. Solving for the conductive flux at the inside surface would require the use of the "Inside" (multiplied by the temperature history at the inside face) terms, the "Cross" (multiplied by the temperature history at the outside face) terms, and the "Flux" (multiplied by the flux history at the inside face) terms. A textual example is given below for illustration purposes:

Current Outside Conductive Flux = (Outside Term 0) * (Current Outside Face Temperature)
+(Outside Term 1) * (Previous Outside Face Temperature)
+(Outside Term 2) * (Outside Face Temperature 2 Time Steps Ago)
+(Outside Term 3) * (Outside Face Temperature 3 Time Steps Ago)
+ ...
+(Cross Term 0) * (Current Inside Face Temperature)
+(Cross Term 1) * (Previous Inside Face Temperature)
+(Cross Term 2) * (Inside Face Temperature 2 Time Steps Ago)
+(Cross Term 3) * (Inside Face Temperature 3 Time Steps Ago)
+ ...
+(Flux Term 1) * (Previous Outside Face Flux)
+(Flux Term 2) * (Outside Face Flux 2 Time Steps Ago)
+(Flux Term 3) * (Outside Face Flux 3 Time Steps Ago)
+ ...

The number of terms is based on the CTF coefficient calculation routine and is related to the amount of thermal mass contained within a particular construction. Actual signs (positive or negative) of various terms in the preceding equation will vary based on their definition and use within the equation. Those interested in more details on the use and calculation of CTFs are encouraged to use the following Ph.D. dissertation resources: Hittle (1981, UIUC), Seem (1986, UW-Madison), Liesen (1995, UIUC), Strand (1995, UIUC).

Field: <CTF>

This will be filled with the constant “CTF” for each CTF coefficient line.

Field: Time

This field "time" refers to the history term to which the coefficients are applied. The last line is the "zero" term that gets applied to the current values of temperatures. The line with a "1" refers to the temperatures and fluxes from the previous time step--previous as in time minus one time step. Time step, in this case, is defined by the construction time step (see description on “Fields in Part 1 – Opaque Construction Report”) *not* the zone time step. Lines with other values are for previous time steps at t-n(timestep). These are the terms that are used to model conduction through a construction.

Field: Outside

Field: Cross

Field: Inside

Field: Flux (except final one)

Description of the Windows Construction Report

A separate report is available for windows (note that both nominal conductance and Solar Heat Gain Coefficient are calculated for windows). Like the opaque construction, the window construction report has multiple parts – in this case, 2.

```
Line 1: ! <WindowConstruction>,Construction Name,#Layers,Roughness,Conductance {w/m2-K},SHGC,SolarTransmittanceNormalIncid,VisibleTransmittanceNormalIncid,DiffuseSolarTransmittance,DiffuseVisibleTransmittance,DiffuseFrontSolarReflectance,DiffuseBackSolarReflectance,DiffuseFrontVisibleReflectance,DiffuseBackVisibleReflectance
Line 2: ! <Material:WindowGlass>,Material Name,Thickness {m},Conductivity {w/m-K},SolarTransmittance,VisibleTransmittance,ThermalFrontAbsorptance,ThermalBackAbsorptance,SolarFrontReflectance,SolarBackReflectance,VisibleFrontReflectance,VisibleBackReflectance
Line 3: ! <Material:WindowGas>,Material Name,GasType,Thickness {m},Conductivity {w/m-K},Density {kg/m3},Viscosity {kg/ms},Prandtl
Line 4: ! <Material:WindowShade>,Material Name,Thickness {m},Conductivity {w/m-K},ThermalAbsorptance,Transmittance,VisibleTransmittance,ShadeReflectance
 Construction,ELECTRO-CON-LIGHT,   3,VerySmooth,   2.657,   0.704,   0.576,   0.746,   0.479,   0.640,   0.208,   0.178,   0.241,   0.238
 Material:WindowGlass,ELECTRO GLASS LIGHT STATE,  0.006,  0.900,  0.814,  0.847,  0.840,  0.840,  0.086,  0.086,  0.099,  0.099
 Material:WindowGas,WINAIRGAP,Air,  1.300E-02,  2.410E-02,  1.290E+00,  1.730E-05,  7.200E-01
 Material:WindowGlass,SPECTRAL GLASS INNER PANE,  0.010,  0.798,  0.000,  0.000,  0.840,  0.840,  0.000,  0.000,  0.000,  0.000
 Construction,ELECTRO-CON-DARK,   3,VerySmooth,   2.657,   0.187,   0.079,   0.113,   0.062,   0.083,   0.214,   0.210,   0.129,   0.214
 Material:WindowGlass,ELECTRO GLASS DARK STATE,  0.006,  0.900,  0.111,  0.128,  0.840,  0.840,  0.179,  0.179,  0.081,  0.081
 Material:WindowGas,WINAIRGAP,Air,  1.300E-02,  2.410E-02,  1.290E+00,  1.730E-05,  7.200E-01
 Material:WindowGlass,SPECTRAL GLASS INNER PANE,  0.010,  0.798,  0.000,  0.000,  0.840,  0.840,  0.000,  0.000,  0.000,  0.000
```

Fields in Part 1 – Window Construction Report

```
Line 1: ! <WindowConstruction>,Construction Name,#Layers,Roughness,Conductance {w/m2-K},SHGC,SolarTransmittanceNormalIncid,VisibleTransmittanceNormalIncid,DiffuseSolarTransmittance,DiffuseVisibleTransmittance,DiffuseFrontSolarReflectance,DiffuseBackSolarReflectance,DiffuseFrontVisibleReflectance,DiffuseBackVisibleReflectance
```

Field: <WindowConstruction>

This will be filled with the constant “Construction” for each Window Construction line.

Field: Construction Name

This is the name of the window as entered in the IDF.

Field: #Layers

This is the number of material layers inferred from the windows construction entry in the IDF. Material layers are listed “outside” to “inside” of the construction. This, of course, depends on the placement of the surface in the building – the “outside” of an internal surface is the layer that is closest to whatever the surface touches whereas the “inside” of an internal surface is the layer that shows in the surface’s “zone”. The outside of an external surface is the layer that faces the outside environment and, again, the inside is the layer that shows in the zone.

Field: Roughness

The window construction takes on the roughness from the outer material layer. Roughness is used in several parts of external environment calculations.

Field: Conductance

This is the center-of-glass conductance of the construction calculated without film coefficients, for ASHRAE winter conditions (inside air temperature = 21.1C (70F), outside air temperature = -17.8C (0F), windspeed = 6.71 m/s (15 mph), no solar radiation). Units are W/m^2-K.

Field: SHGC

This is the center-of-glass Solar Heat Gain Coefficient for ASHRAE summer conditions (inside air temperature = 23.9C (75F), outside air temperature = 31.7C (89F), windspeed = 3.35 m/s (7.5 mph), 783 W/m2 (248 Btu/h-ft2) incident beam solar radiation normal to glazing.

The following transmittance and reflectance values are for the window glazing (plus shade or blind, if present in the construction). For exterior windows, “front” means the side of the window facing the exterior environment and “back” means the side facing the zone. For interior windows, “front” means the side to window facing the zone and “back” means the side facing the adjacent zone.

Field: Solar Transmittance at Normal Incidence

Transmittance at normal incidence averaged over the solar spectrum.

Field: Visible Transmittance at Normal Incidence

Transmittance normal incidence averaged over the solar spectrum and weighted by the response of the human eye.

Field: Diffuse Solar Transmittance

Hemispherical diffuse transmittance averaged over the solar spectrum.

Field: Diffuse Visible Transmittance

Hemispherical diffuse transmittance averaged over the solar spectrum and weighted by the response of the human eye.

Field: Diffuse Front Solar Reflectance

Hemispherical diffuse reflectance--averaged over the solar spectrum—for radiation incident on the front of the window.

Field: Diffuse Back Solar Reflectance

Hemispherical diffuse reflectance--averaged over the solar spectrum—for radiation incident on the back of the window.

Field: Diffuse Front Visible Reflectance

Hemispherical diffuse reflectance--averaged over the solar spectrum and weighted by the response of the human eye —for radiation incident on the front of the window.

Field: Diffuse Back Visible Reflectance

Hemispherical diffuse reflectance--averaged over the solar spectrum and weighted by the response of the human eye —for radiation incident on the back of the window.

Fields in Part 2 – Window Construction Report

Part 2 of the Window Construction Report encompasses several “lines”.

```
Line 2: ! <Material:WindowGlass>,Material Name,Thickness {m},Conductivity {w/m-K},SolarTransmittance,VisibleTransmittance,ThermalFrontAbsorptance,ThermalBackAbsorptance,SolarFrontReflectance,SolarBackReflectance,VisibleFrontReflectance,VisibleBackReflectance
Line 3: ! <Material:WindowGas>,Material Name,GasType,Thickness {m},Conductivity {w/m-K},Density {kg/m3},Viscosity {kg/ms},Prandtl
Line 4: ! <Material:WindowShade>,Material Name,Thickness {m},Conductivity {w/m-K},ThermalAbsorptance,Transmittance,VisibleTransmittance,ShadeReflectance
Line 5: ! <Material:WindowBlind>,Material Name,SlatWidth {m},SlatSeparation {m},SlatThickness {m},SlatAngle {deg},SlatBeamSolarTransmittance,SlatBeamSolarFrontReflectance,BlindToGlassDistance {m}
```

Material:WindowGlass

Field: <Material:WindowGlass>

This will be filled with the constant “Material:WindowGlass” for each material of this type in the construction.

Field: Material Name

Name of the glass layer.

Field: Thickness {m}

Thickness of the glass layer.

Field: Conductivity {w/m-K}

Conductivity of the glass layer.

Field: SolarTransmittance

Transmittance of the glass layer at normal incidence averaged over the solar spectrum.

Field: VisibleTransmittance

Transmittance normal incidence of the glass layer averaged over the solar spectrum and weighted by the response of the human eye.

Field: ThermalFrontAbsorptance

Thermal emissivity of the front face of the glass layer.

Field: ThermalBackAbsorptance

Thermal emissivity of the back face of the glass layer.

Field: SolarFrontReflectance

Reflectance of the front face of the glass layer at normal incidence averaged over the solar spectrum.

Field: SolarBackReflectance

Reflectance of the back face of the glass layer at normal incidence averaged over the solar spectrum.

Field: VisibleFrontReflectance

Reflectance of the front face of the glass layer at normal incidence averaged over the solar spectrum.

Field: VisibleBackReflectance

Reflectance of the back face of the glass layer at normal incidence averaged over the solar spectrum.

Material:WindowGas

Field: <Material:WindowGas>

This will be filled with the constant “Material:WindowGas” for each material of this type in the construction.

Field: Material Name

Name of the gas layer.

Field: GasType

Type of the gas layer. Possibilities are Air, Argon, Krypton, Xenon, and Custom.

Field: Thickness {m}

Thickness of the gas layer.

Material:WindowShade

Field: <Material:WindowShade>

This will be filled with the constant “Material:WindowShade” for each material of this type in the construction.

Field: Material Name

Name of the window shade layer.

Field: Thickness {m}

Thickness of the window shade layer.

Field: Conductivity {w/m-K}

Thermal conductivity of the window shade layer.

Field: ThermalAbsorptance

Emissivity of the window shade layer (assumed same for front and back faces).

Field: SolarTransmittance

Transmittance of the window shade layer averaged over the solar spectrum. Assumed same for beam solar radiation and diffuse solar radiation. Transmittance of beam solar radiation is assumed to be independent of angle of incidence.

Field: VisibleTransmittance

Transmittance of the window shade layer averaged over the solar spectrum and weighted by the response of the human eye. Assumed same for beam visible radiation and diffuse visible radiation. Transmittance of beam visible radiation is assumed to be independent of angle of incidence.

Field: ShadeReflectance

Reflectance of the window shade layer averaged over the solar spectrum. Assumed same for beam solar radiation and diffuse solar radiation. Reflectance of beam solar radiation is assumed to be independent of angle of incidence. Reflectance is assumed to be the same for the front and back faces of the shade layer.

Material:WindowBlind

This will be filled with the constant "Material:WindowBlind" for each material of this type in the construction.

Field: <Material:WindowBlind>

Field: Material Name

Name of the blind layer.

Field: SlatWidth {m}

Width of the slats in the blind.

Field: SlatSeparation {m}

Distance between the centerline of adjacent slats.

Field: SlatThickness {m}

Distance between front and back faces of a slat.

Field: SlatAngle {deg}

This is the angle between the glazing outward normal and the slat outward normal, where the outward normal points away from the front face of the slat.

Field: SlatBeamSolarTransmittance

The beam solar transmittance of the slat at normal incidence. Any transmitted beam radiation is assumed to be 100% diffuse (i.e., slats are translucent). Transmittance is assumed to have the same value at other angles of incidence.

Field: SlatBeamSolarFrontReflectance

The beam solar reflectance at normal incidence on the front side of the slat. Assumed to have the same value at other angles of incidence (matte finish).

Field: BlindToGlassDistance {m}

Distance from the mid-plane of the blind to the adjacent glass (m).

Sizing Information

Details about sizing information and fields will be included at a later date.

```
! <Sizing Factor Information>, Sizing Factor ID, Value
 Sizing Factor, Global,   1.3000
 Sizing Factor, Zone SPACE1-1,   1.3000
 Sizing Factor, Zone SPACE2-1,   1.3000
 Sizing Factor, Zone SPACE3-1,   1.3000
 Sizing Factor, Zone SPACE4-1,   1.3000
 Sizing Factor, Zone SPACE5-1,   1.3000
! <Zone Sizing Information>, Zone Name, Field Description, Value
 Zone Sizing, SPACE1-1, Calculated cooling design air flow rate [m3/s],  0.20776
 Zone Sizing, SPACE1-1, User cooling design air flow rate [m3/s],  0.27008
 Zone Sizing, SPACE1-1, Calculated heating design air flow rate [m3/s],  0.17906
 Zone Sizing, SPACE1-1, User heating design air flow rate [m3/s],  0.23278
 Zone Sizing, SPACE2-1, Calculated cooling design air flow rate [m3/s],  0.15774
 Zone Sizing, SPACE2-1, User cooling design air flow rate [m3/s],  0.20506
 Zone Sizing, SPACE2-1, Calculated heating design air flow rate [m3/s],  0.74198E-01
 Zone Sizing, SPACE2-1, User heating design air flow rate [m3/s],  0.96458E-01
 Zone Sizing, SPACE3-1, Calculated cooling design air flow rate [m3/s],  0.20854
 Zone Sizing, SPACE3-1, User cooling design air flow rate [m3/s],  0.27110
 Zone Sizing, SPACE3-1, Calculated heating design air flow rate [m3/s],  0.17520
 Zone Sizing, SPACE3-1, User heating design air flow rate [m3/s],  0.22776
 Zone Sizing, SPACE4-1, Calculated cooling design air flow rate [m3/s],  0.21960
 Zone Sizing, SPACE4-1, User cooling design air flow rate [m3/s],  0.28549
 Zone Sizing, SPACE4-1, Calculated heating design air flow rate [m3/s],  0.74185E-01
 Zone Sizing, SPACE4-1, User heating design air flow rate [m3/s],  0.96441E-01
 Zone Sizing, SPACE5-1, Calculated cooling design air flow rate [m3/s],  0.21189
 Zone Sizing, SPACE5-1, User cooling design air flow rate [m3/s],  0.27546
 Zone Sizing, SPACE5-1, Calculated heating design air flow rate [m3/s],  0.18939
 Zone Sizing, SPACE5-1, User heating design air flow rate [m3/s],  0.24621
```

```
! <Component Sizing Information>, Component Type, Component Name, Input Field Description, Value
 Component Sizing, SINGLE DUCT:VAV:REHEAT, SPACE1-1 VAV REHEAT, Maximum air flow rate [m3/s],  0.27008
 Component Sizing, SINGLE DUCT:VAV:REHEAT, SPACE1-1 VAV REHEAT, Max Reheat Water Flow [m3/s],  0.20094E-03
 Component Sizing, COIL:Water:SimpleHeating, SPACE1-1 ZONE COIL, Max Water Flow Rate of Coil [m3/s],
0.20094E-03
 Component Sizing, COIL:Water:SimpleHeating, SPACE1-1 ZONE COIL, UA of the Coil [W/delK],   212.96
 Component Sizing, SINGLE DUCT:VAV:REHEAT, SPACE2-1 VAV REHEAT, Maximum air flow rate [m3/s],  0.20506
 Component Sizing, SINGLE DUCT:VAV:REHEAT, SPACE2-1 VAV REHEAT, Max Reheat Water Flow [m3/s],  0.83263E-04
 Component Sizing, COIL:Water:SimpleHeating, SPACE2-1 ZONE COIL, Max Water Flow Rate of Coil [m3/s],
0.83263E-04
 Component Sizing, COIL:Water:SimpleHeating, SPACE2-1 ZONE COIL, UA of the Coil [W/delK],   76.984
 Component Sizing, SINGLE DUCT:VAV:REHEAT, SPACE3-1 VAV REHEAT, Maximum air flow rate [m3/s],  0.27110
 Component Sizing, SINGLE DUCT:VAV:REHEAT, SPACE3-1 VAV REHEAT, Max Reheat Water Flow [m3/s],  0.19660E-03
 Component Sizing, COIL:Water:SimpleHeating, SPACE3-1 ZONE COIL, Max Water Flow Rate of Coil [m3/s],
0.19660E-03
 Component Sizing, COIL:Water:SimpleHeating, SPACE3-1 ZONE COIL, UA of the Coil [W/delK],   206.51
 Component Sizing, SINGLE DUCT:VAV:REHEAT, SPACE4-1 VAV REHEAT, Maximum air flow rate [m3/s],  0.28549
 Component Sizing, SINGLE DUCT:VAV:REHEAT, SPACE4-1 VAV REHEAT, Max Reheat Water Flow [m3/s],  0.83248E-04
 Component Sizing, COIL:Water:SimpleHeating, SPACE4-1 ZONE COIL, Max Water Flow Rate of Coil [m3/s],
0.83248E-04
 Component Sizing, COIL:Water:SimpleHeating, SPACE4-1 ZONE COIL, UA of the Coil [W/delK],   74.385
 Component Sizing, SINGLE DUCT:VAV:REHEAT, SPACE5-1 VAV REHEAT, Maximum air flow rate [m3/s],  0.27546
 Component Sizing, SINGLE DUCT:VAV:REHEAT, SPACE5-1 VAV REHEAT, Max Reheat Water Flow [m3/s],  0.21253E-03
 Component Sizing, COIL:Water:SimpleHeating, SPACE5-1 ZONE COIL, Max Water Flow Rate of Coil [m3/s],
0.21253E-03
 Component Sizing, COIL:Water:SimpleHeating, SPACE5-1 ZONE COIL, UA of the Coil [W/delK],   228.29
 Component Sizing, BRANCH, VAV SYS 1 MAIN BRANCH, Maximum Branch Flow Rate [m3/s],   1.3072
 Component Sizing, AIR PRIMARY LOOP, VAV SYS 1, Primary air design volumetric flow rate [m3/s],   1.3072
 Component Sizing, CONTROLLER:OUTSIDE AIR, OA CONTROLLER 1, maximum outside air flow rate [m3/s],   1.3072
 Component Sizing, CONTROLLER:OUTSIDE AIR, OA CONTROLLER 1, minimum outside air flow rate [m3/s],  0.49088
 Component Sizing, COIL:Water:SimpleCooling, MAIN COOLING COIL 1, Max Water Flow Rate of Coil [m3/s],
0.77160E-03
 Component Sizing, COIL:Water:SimpleCooling, MAIN COOLING COIL 1, UA of the Coil [W/delK],   3485.3
 Component Sizing, COIL:Water:SimpleHeating, MAIN HEATING COIL 1, Max Water Flow Rate of Coil [m3/s],
0.43138E-03
 Component Sizing, COIL:Water:SimpleHeating, MAIN HEATING COIL 1, UA of the Coil [W/delK],   290.82
 Component Sizing, FAN:SIMPLE:VARIABLEVOLUME, SUPPLY FAN 1, Max Flow Rate [m3/s],   1.3072
 Component Sizing, FAN:SIMPLE:VARIABLEVOLUME, SUPPLY FAN 1, Min Flow Rate [m3/s],  0.39215
 Component Sizing, CONTROLLER:SIMPLE, CENTRAL COOLING COIL CONTOLLER 1, Max Actuated Flow [m3/s],
0.77160E-03
 Component Sizing, CONTROLLER:SIMPLE, CENTRAL HEATING COIL CONTOLLER 1, Max Actuated Flow [m3/s],
0.43138E-03
 Component Sizing, PLANT LOOP, HOT WATER LOOP, Volume of the plant loop [m3],   1.3589
 Component Sizing, PLANT LOOP, CHILLED WATER LOOP, Volume of the plant loop [m3],  0.86806
 Component Sizing, PLANT LOOP, HOT WATER LOOP, Maximum Loop Volumetric Flow Rate [m3/s],  0.12080E-02
 Component Sizing, PLANT LOOP, CHILLED WATER LOOP, Maximum Loop Volumetric Flow Rate [m3/s],  0.77160E-03
 Component Sizing, BOILER:SIMPLE, CENTRAL BOILER, Nominal Capacity [W],   55542.
 Component Sizing, BOILER:SIMPLE, CENTRAL BOILER, Design Boiler Water Flow Rate [m3/s],  0.12080E-02
 Component Sizing, CHILLER:ELECTRIC, CENTRAL CHILLER, Nominal Capacity [W],   21513.
 Component Sizing, CHILLER:ELECTRIC, CENTRAL CHILLER, Design Evaporator Volumetric Water Flow Rate [m3/s],
0.77160E-03
 Component Sizing, PUMP:VARIABLE SPEED, HW CIRC PUMP, Rated Volumetric Flow Rate [m3/s],  0.12080E-02
 Component Sizing, PUMP:VARIABLE SPEED, HW CIRC PUMP, Rated Power Consumption [W],   309.50
 Component Sizing, PUMP:VARIABLE SPEED, CW CIRC PUMP, Rated Volumetric Flow Rate [m3/s],  0.77160E-03
 Component Sizing, PUMP:VARIABLE SPEED, CW CIRC PUMP, Rated Power Consumption [W],   197.70
```

eplusout.end

This is a simple one line synopsis of the simulation. Successful or Not Successful, including number of errors/warnings:

```
EnergyPlus Completed Successfully-- 8 Warning; 0 Severe Errors
```

If no file is produced, it is really *not* successful and EnergyPlus has probably crashed during the run. This file and its contents are intended for interfaces that will put friendly front-ends onto EnergyPlus. This file is also used by the EP-Launch program so that it can determine if the run was successful or not – if not, the user should review the eplusout.err file. (Actually, the eplusout.err file should always be reviewed but often is ignored in haste to view the results.)

eplusout.epmidf

If you use an EPMacro file (usual extension is .imf) as your basis for input, then this file is the “idf” that the EPMacro program produces.

eplusout.epmdet

If you use an EPMacro file (usual extension is .imf) as your basis for input, then this file is the details of the EPMacro run (including any error messages).

eplusout.err

This file is *very important* to every simulation run. All of the warnings, errors, etc that occur during the run will show up in this file. They may show up in other files as well. The first line of the error file is also significant:

```
Program Version,EnergyPlus, Version 1.2.1,IDD_Version 1.2.1.010
```

This shows not only the current version of the program but the “version” of the Energy+.idd file that was used.

Table 3. EnergyPlus Errors

Error Level	Action
Warning	Take note
Severe	Should Fix
Fatal	Program will abort

The previous table illustrates the three levels of errors that occur in the eplusout.err file. Several other message lines may be shown as well. For example:

```
   ** Warning ** World Coordinate System selected.  Some Zone Origins are non-zero.
   **   ~~~   ** These will be used in Daylighting:Detailed calculations but not in normal geometry
inputs.
```

The line that includes the “~~~” is a “continue” error line. It continues from the previous line to help describe the context of the error.

Some common errors, their consequences, and what to do about them follows:

```
   ** Severe  ** Possible incorrect IDD File
   ** Severe  ** Possible Invalid Numerics
   **  Fatal  ** Errors occurred on processing IDF file. Preceding condition(s) cause termination.
```

The previous errors cause program termination. The most likely cause is that you have an “old” IDF and have not converted it to work with the current version of the program. In this case, you will likely has some other hints such as alphas in numeric fields or too many fields in an object. Energyplus also has built in range checking:

```
   ** Severe  ** Out of range value numeric Field#7 (Sky Clearness),
value=100.00000, range=>=0.0 and <=1.2, in DESIGNDAY=FALL
```

The error message should supply you with enough information to find the line with the error.

Error – <schedule not found>

All, or virtually all, objects that have schedules in their fields must have a schedule actually input into this field. To leave it blank will result in a severe error that will later terminate the run.

Schedule <schedule name> has missing days

Schedule periods in EnergyPlus must fill a full year.

Zone Name in <internal gain> statement not found

If a statement specifies a zone name as part of its fields, it cannot be left blank.

eplusout.eso

The standard output file from EnergyPlus. It includes all the applicable variables selected with the "Report Variable" commands as well as those with the "Report Meter" commands. All levels of frequency of reporting are included intermingled as occurs in the running of the program. The form of the file is a data dictionary, followed by the data.

In this case, the dictionary portion of the file comes first followed by an "end of data dictionary line" and then the data makes up the rest of the file.

```
Program Version,EnergyPlus, Version 1.0.1
     1,5,Environment Title[],Latitude[degrees],Longitude[degrees],Time Zone[],Elevation[m]
     2,6,Day of Simulation[],Month[],Day of Month[],DST Indicator[1=yes
0=no],Hour[],StartMinute[],EndMinute[],DayType
     3,3,Cumulative Day of Simulation[],Month[],Day of Month[],DST Indicator[1=yes 0=no],DayType  ! When
Daily Report Variables Requested
     4,2,Cumulative Days of Simulation[],Month[]  ! When Monthly Report Variables Requested
     5,1,Cumulative Days of Simulation[] ! When Run Period Report Variables Requested
6,2,Environment,Outdoor Dry Bulb [C] !Hourly
429,2,RESISTIVE ZONE,Zone/Sys Sensible Heating Energy[J] !Hourly
450,2,RESISTIVE ZONE,Zone/Sys Sensible Cooling Energy[J] !Hourly
458,2,RESISTIVE ZONE,Zone/Sys Air Temp[C] !Hourly
463,2,EAST ZONE,Zone/Sys Sensible Heating Energy[J] !Hourly
469,2,EAST ZONE,Zone/Sys Sensible Cooling Energy[J] !Hourly
472,2,EAST ZONE,Zone/Sys Air Temp[C] !Hourly
477,2,NORTH ZONE,Zone/Sys Sensible Heating Energy[J] !Hourly
483,2,NORTH ZONE,Zone/Sys Sensible Cooling Energy[J] !Hourly
486,2,NORTH ZONE,Zone/Sys Air Temp[C] !Hourly
491,2,SimHVAC,HVACManage Iterations !Hourly
521,2,SimAir,Max SimAir Iterations !Hourly
<reduced for brevity>
End of Data Dictionary
  1,CHANUTE AFB ILLINOIS SUMMER,  40.30, -88.13,  -6.00, 229.51
  2,   1, 7,21, 0, 1, 0.00,60.00,Monday
6,21.2884261500000
429,0.000000000000000E+000
450,0.000000000000000E+000
458,31.1054947436037
463,0.000000000000000E+000
469,0.000000000000000E+000
472,31.2222148107451
477,0.000000000000000E+000
483,0.000000000000000E+000
486,31.5855358697037
```

Each report variable (ref: eplusout.rdd) is assigned an identification number, as in the line:

```
486,2,NORTH ZONE,Zone/Sys Air Temp[C] !Hourly
```

#486 is the id number of the Zone/Sys Air Temp value for the North Zone.

2 – is the number of parameters on the line

North Zone – the identifying "key name" for the line

Zone/Sys Air Temp [C] – the actual report variable name along with units [C]

! Hourly – the ! is the standard comment character, information following this character reminds the user how frequently this data will appear in the following.

More details on this file format can be found in the Interface Developer's Guide.

eplusout.log

When EnergyPlus is running, it is usually running from a “command” window (unless inside another interface program) and some items may appear in the command window. These messages are preserved in the “log” output file. For example:

```
 EnergyPlus Starting
 EnergyPlus, Version 1.2.1
 Warming up
 Initializing Response Factors
 Calculating CTFs for "EXTWALL80", Construction #1
 Calculating CTFs for "PARTITION06", Construction #2
 Calculating CTFs for "FLOOR SLAB 8 IN", Construction #3
 Calculating CTFs for "ROOF34", Construction #4
 Initializing Window Optical Properties
 Initializing Solar Calculations
 Initializing HVAC
 Warming up
 Warming up
 Performing Zone Sizing Simulation
 Warming up
 Warming up
 Warming up
 Performing Zone Sizing Simulation
 Initializing New Environment Parameters
 Warming up
 Warming up
 Warming up
 Warming up
 Starting Simulation at 01/14 for CHICAGO IL USA TMY2-94846 WMO#=725300
 Initializing New Environment Parameters
 Warming up
 Warming up
 Warming up
 Warming up
 Starting Simulation at 07/07 for CHICAGO IL USA TMY2-94846 WMO#=725300
 EnergyPlus Run Time=00hr 00min  7.30sec
ReadVarsESO program starting.
ReadVars Run Time=00hr 00min  0.04sec
ReadVarsESO program completed successfully.
ReadVarsESO program starting.
ReadVars Run Time=00hr 00min  0.01sec
ReadVarsESO program completed successfully.
  Started HVAC Diagram
  Complete
```

eplusout.mtd

This file contains the “meter details” for the run. This shows what report variables are on which meters and vice versa – which meters contain what report variables.

An abbreviated example shows:

```
Meters for 356,EAST ZONE:Lights-Electric Consumption[J]
  OnMeter=Electricity:Facility [J]
  OnMeter=Electricity:Building [J]
  OnMeter=Electricity:Zone:EAST ZONE [J]
  OnMeter=GeneralLights:Electricity [J]
  OnMeter=GeneralLights:Electricity:Zone:EAST ZONE [J]

 For Meter=Electricity:Facility [J], contents are:
  EAST ZONE:Lights-Electric Consumption[J]
  NORTH ZONE:Lights-Electric Consumption[J]
  RESISTIVE ZONE:Electric Eq-Consumption[J]
  EAST ZONE:Electric Eq-Consumption[J]
  NORTH ZONE:Electric Eq-Consumption[J]
  SUPPLY FAN 1:Fan Electric Consumption[J]
```

```
  LITTLE CHILLER:Chiller Electric Consumption [J]
  BIG CHILLER:Chiller Electric Consumption [J]
  CIRC PUMP:Pump Electric Consumption [J]
  COND CIRC PUMP:Pump Electric Consumption [J]
  HW CIRC PUMP:Pump Electric Consumption [J]
  BIG TOWER:Tower Fan Electric Consumption [J]
```

This shows the meters on which the Zone:Lights – Electric Consumption appear as well as the contents of the Electricity:Facility meter.

eplusout.mtr

This is the equivalent file to the eplusout.eso file but contains only the Report Meter requests. The format and style of the file is identical to the eplusout.eso file.

eplusout.rdd

This file (invoked by the Report,Variable Dictionary; command) shows all the report variables along with their "availability" for the current input file.

"**Zone**" variables are calculated and can be reported after each Zone/Heat Balance timestep (ref: TimeSteps in Hour command). "**HVAC**" variables are calculated and can be reported with each variable HVAC timestep. "Average" variables will be averaged over the time interval being reported whereas "sum" variables are summed over that time interval.

A typical rdd file might be:

```
Program Version,EnergyPlus, Version 1.2.0
 Var Type,Var Report Type,Variable Name [Units]
Zone,Average,Outdoor Dry Bulb [C]
Zone,Average,Outdoor Dew Point [C]
Zone,Average,Outdoor Wet Bulb [C]
Zone,Average,Outdoor Humidity Ratio [kgWater/kgAir]
Zone,Average,Outdoor Relative Humidity [%]
Zone,Average,Outdoor Barometric Pressure [Pa]
Zone,Average,Wind Speed [m/s]
Zone,Average,Wind Direction [degree]
Zone,Average,Sky Temperature [C]
Zone,Average,Diffuse Solar [W/m2]
Zone,Average,Direct Solar [W/m2]
Zone,Average,Ground Reflected Solar [W/m2]
Zone,Average,Ground Temperature [C]
Zone,Average,Surface Ground Temperature [C]
Zone,Average,Deep Ground Temperature [C]
Zone,Average,Outdoor Enthalpy [J/kg]
Zone,Average,Outdoor Air Density [kg/m3]
Zone,Average,Solar Azimuth Angle [degree]
Zone,Average,Solar Altitude Angle [degree]
Zone,Average,Solar Hour Angle [degree]
```

```
Zone,Sum,Raining
Zone,Sum,Snow On Ground
Zone,Average,Zone Transmitted Solar[W]
Zone,Average,Zone Window Heat Gain[W]
Zone,Average,Zone Window Heat Loss[W]
Zone,Average,Zone Opaque Surface Inside Face Conduction Gain[W]
Zone,Average,Zone Opaque Surface Inside Face Conduction Loss[W]
Zone,Average,Surface Ext Sunlit Area [m2]
Zone,Average,Surface Ext Sunlit Fraction []
Zone,Average,Surface Ext Solar Incident[W/m2]
Zone,Average,Surface Ext Solar Beam Incident[W/m2]
Zone,Average,Surface Ext Solar Sky Diffuse Incident[W/m2]
Zone,Average,Surface Ext Solar Ground Diffuse Incident[W/m2]
Zone,Average,Surface Ext Solar Beam Cosine Of Incidence Angle[]
Zone,Average,Window Solar Absorbed:All Glass Layers[W]
Zone,Average,Window Transmitted Solar[W]
Zone,Average,Window Heat Gain[W]
Zone,Average,Window Heat Loss[W]
Zone,Average,Window Gap Convective Heat Flow[W]
Zone,Average,Window Solar Absorbed:Shading Device[W]
Zone,Average,Window System Solar Transmittance[]
Zone,Average,Window System Solar Reflectance[]
Zone,Average,Window System Solar Absorptance[]
Zone,Average,Inside Glass Condensation Flag[]
Zone,Average,Inside Frame Condensation Flag[]
Zone,Average,Inside Divider Condensation Flag[]
Zone,Average,Beam Solar Reflected by Outside Reveal Surfaces[W]
Zone,Average,Beam Solar Reflected by Inside Reveal Surfaces[W]
Zone,Average,Blind Beam-Beam Solar Transmittance[]
Zone,Average,Blind Beam-Diffuse Solar Transmittance[]
Zone,Average,Blind Diffuse-Diffuse Solar Transmittance[]
Zone,Average,Blind/Glass System Beam-Beam Solar Transmittance[]
Zone,Average,Blind/Glass System Diffuse-Diffuse Solar Transmittance[]
Zone,Average,Solar Horizontal Profile Angle[degree]
Zone,Average,Solar Vertical Profile Angle[degree]
Zone,Average,Glass Beam-Beam Solar Transmittance[]
Zone,Average,Glass Diffuse-Diffuse Solar Transmittance[]
Zone,Average,Window Calculation Iterations[]
Zone,Average,Surface Inside Temperature[C]
Zone,Average,Surface Outside Temperature[C]
Zone,Average,Surface Int Convection Coeff[W/m2-K]
Zone,Average,Surface Ext Convection Coeff[W/m2-K]
Zone,Average,Surface Ext Rad to Air Coeff[W/m2-K]
Zone,Average,Surface Ext Rad to Sky Coeff[W/m2-K]
Zone,Average,Surface Ext Rad to Ground Coeff[W/m2-K]
Zone,Average,Opaque Surface Inside Face Conduction[W]
Zone,Average,Opaque Surface Inside Face Conduction Gain[W]
Zone,Average,Opaque Surface Inside Face Conduction Loss[W]
Zone,Average,Opaque Surface Inside Face Beam Solar Absorbed[W]
Zone,Average,Fraction of Time Shading Device Is On []
Zone,Average,Window Blind Slat Angle [deg]
Zone,Average,Mean Radiant Temperature[C]
Zone,Sum,Zone-Total Internal Latent Gain[J]
Zone,Sum,Zone-Total Internal Radiant Heat Gain[J]
Zone,Sum,Zone-Total Internal Convective Heat Gain[J]
Zone,Sum,Zone-Total Internal Lost Heat Gain[J]
Zone,Sum,Zone-Total Internal Visible Heat Gain[J]
Zone,Average,People-Number of Occupants[]
Zone,Sum,People-Radiant Heat Gain[J]
Zone,Sum,People-Convective Heat Gain[J]
Zone,Sum,People-Sensible Heat Gain[J]
Zone,Sum,People-Latent Heat Gain[J]
Zone,Sum,People-Total Heat Gain[J]
Zone,Sum,Lights-Return Air Heat Gain[J]
Zone,Sum,Lights-Radiant Heat Gain[J]
Zone,Sum,Lights-Convective Heat Gain[J]
Zone,Sum,Lights-Visible Heat Gain[J]
Zone,Sum,Lights-Total Heat Gain[J]
Zone,Meter,Electricity:Facility [J]
Zone,Meter,Electricity:Building [J]
Zone,Meter,Electricity:Zone:SPACE1-1 [J]
```

```
Zone,Meter,GeneralLights:Electricity [J]
Zone,Meter,GeneralLights:Electricity:Zone:SPACE1-1 [J]
Zone,Sum,Lights-Electric Consumption[J]
Zone,Meter,Electricity:Zone:SPACE2-1 [J]
Zone,Meter,GeneralLights:Electricity:Zone:SPACE2-1 [J]
Zone,Meter,Electricity:Zone:SPACE3-1 [J]
Zone,Meter,GeneralLights:Electricity:Zone:SPACE3-1 [J]
Zone,Meter,Electricity:Zone:SPACE4-1 [J]
Zone,Meter,GeneralLights:Electricity:Zone:SPACE4-1 [J]
Zone,Meter,Electricity:Zone:SPACE5-1 [J]
Zone,Meter,GeneralLights:Electricity:Zone:SPACE5-1 [J]
Zone,Sum,Electric Eq-Total Heat Gain[J]
Zone,Sum,Electric Eq-Radiant Heat Gain[J]
Zone,Sum,Electric Eq-Convective Heat Gain[J]
Zone,Sum,Electric Eq-Latent Heat Gain[J]
Zone,Sum,Electric Eq-Lost Heat Gain[J]
Zone,Sum,Electric Eq-Consumption[J]
Zone,Sum,Cat00 Electric Eq-Total Heat Gain[J]
Zone,Sum,Cat00 Electric Eq-Radiant Heat Gain[J]
Zone,Sum,Cat00 Electric Eq-Convective Heat Gain[J]
Zone,Sum,Cat00 Electric Eq-Latent Heat Gain[J]
Zone,Sum,Cat00 Electric Eq-Lost Heat Gain[J]
Zone,Meter,Cat00_ZoneSource:Electricity [J]
Zone,Sum,Cat00 Electric Eq-Consumption[J]
Zone,Average,Mean Air Temperature[C]
Zone,Sum,Infiltration-Sensible Heat Loss[J]
Zone,Sum,Infiltration-Sensible Heat Gain[J]
Zone,Sum,Infiltration-Volume[m3]
Zone,Sum,Infiltration-Mass[kg]
Zone,Sum,Infiltration-Air Change Rate[ach]
Zone,Meter,EnergyTransfer:Facility [J]
Zone,Meter,EnergyTransfer:Building [J]
Zone,Meter,EnergyTransfer:Zone:PLENUM-1 [J]
Zone,Meter,Heating:EnergyTransfer [J]
HVAC,Sum,Zone/Sys Sensible Heating Energy[J]
Zone,Meter,Cooling:EnergyTransfer [J]
HVAC,Sum,Zone/Sys Sensible Cooling Energy[J]
HVAC,Average,Zone/Sys Sensible Heating Rate[W]
HVAC,Average,Zone/Sys Sensible Cooling Rate[W]
HVAC,Average,Zone/Sys Air Temp[C]
HVAC,Average,Zone Air Humidity Ratio[]
HVAC,Average,Zone Air Relative Humidity[%]
HVAC,Average,Zone/Sys Sensible Load Predicted[W]
HVAC,Average,Zone/Sys Moisture Load Rate Predicted[kgWater/sec]
Zone,Meter,EnergyTransfer:Zone:SPACE1-1 [J]
Zone,Meter,EnergyTransfer:Zone:SPACE2-1 [J]
Zone,Meter,EnergyTransfer:Zone:SPACE3-1 [J]
Zone,Meter,EnergyTransfer:Zone:SPACE4-1 [J]
Zone,Meter,EnergyTransfer:Zone:SPACE5-1 [J]
HVAC,Sum,HVACManage Iterations
HVAC,Average,Damper Position
Zone,Meter,EnergyTransfer:HVAC [J]
Zone,Meter,HeatingCoils:EnergyTransfer [J]
HVAC,Sum,Heating Coil Energy[J]
HVAC,Average,Heating Coil Rate[W]
Zone,Meter,Gas:Facility [J]
Zone,Meter,Gas:HVAC [J]
Zone,Meter,Heating:Gas [J]
HVAC,Sum,Heating Coil Gas Consumption [J]
HVAC,Average,Heating Coil Gas Consumption Rate [W]
Zone,Meter,Electricity:HVAC [J]
Zone,Meter,Heating:Electricity [J]
HVAC,Sum,Heating Coil Electric Consumption [J]
HVAC,Average,Heating Coil Electric Power [W]
HVAC,Average,Heating Coil Runtime Fraction
HVAC,Average,Heating Coil Parasitic Gas Consumption Rate [W]
Zone,Meter,Miscellaneous:Gas [J]
HVAC,Sum,Heating Coil Parasitic Gas Consumption [J]
HVAC,Average,System Cycle On/Off Status
HVAC,Sum,Max SimAir Iterations
HVAC,Average,DXSystem Cycling Part-Load Ratio
```

```
HVAC,Average,DXSystem Compressor Speed Ratio
HVAC,Average,DX Coil Total Cooling Rate[W]
Zone,Meter,CoolingCoils:EnergyTransfer [J]
HVAC,Sum,DX Coil Total Cooling Energy[J]
HVAC,Average,DX Coil Sensible Cooling Rate[W]
HVAC,Sum,DX Coil Sensible Cooling Energy[J]
HVAC,Average,DX Coil Latent Cooling Rate[W]
HVAC,Sum,DX Coil Latent Cooling Energy[J]
HVAC,Average,DX Cooling Coil Electric Power[W]
Zone,Meter,Cooling:Electricity [J]
HVAC,Sum,DX Cooling Coil Electric Consumption[J]
HVAC,Average,DX Cooling Coil Runtime Fraction
HVAC,Average,Fan Electric Power[W]
HVAC,Average,Fan Delta Temp[C]
Zone,Meter,Fans:Electricity [J]
HVAC,Sum,Fan Electric Consumption[J]
HVAC,Average,System Node Temp[C]
HVAC,Average,System Node MassFlowRate[kg/s]
HVAC,Average,System Node Humidity Ratio[]
HVAC,Average,System Node Setpoint Temp[C]
```

eplusout.sln

The following shows an excerpt of "lines" report (**eplusout.sln**) for a single surface. It gives the coordinates in the "standard" EnergyPlus fashion (that is, UpperLeftCorner first and proceeding around, in this case, the four vertices in the surface.

```
     0.00,       0.00,       4.57,       0.00,       0.00,       0.00
     0.00,       0.00,       0.00,      15.24,       0.00,       0.00
    15.24,       0.00,       0.00,      15.24,       0.00,       4.57
    15.24,       0.00,       4.57,       0.00,       0.00,       4.57
```

eplusssz.<ext>

This file is the result of the System Sizing object and execution. As usual, the file can be read into a spreadsheet for easy viewing. An excerpt:

```
Time,:Des Heat Mass Flow [kg/s],:Des Cool Mass Flow [kg/s],:Des Heat Cap [W],:Des Sens Cool Cap [W],
00:15:00,1.063942E+00,0.000000E+00,5.944201E+03,0.000000E+00,
00:30:00,1.063942E+00,0.000000E+00,5.944201E+03,0.000000E+00,
00:45:00,1.063942E+00,0.000000E+00,5.944201E+03,0.000000E+00,
01:00:00,1.063942E+00,0.000000E+00,5.944201E+03,0.000000E+00,
01:15:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
01:30:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
01:45:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
02:00:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
02:15:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
02:30:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
02:45:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
03:00:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
```

```
03:15:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
03:30:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
03:45:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
04:00:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
04:15:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
04:30:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
04:45:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
05:00:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
05:15:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
05:30:00,1.063942E+00,0.000000E+00,5.944200E+03,0.000000E+00,
=== reduced for brevity ===
```

```
Coinc Peak   ,1.063943E+00,1.378986E+00,5.944199E+03,2.165922E+04,
NonCoinc Peak,1.063943E+00,1.553319E+00,5.944199E+03,2.165922E+04,
```

Or as depicted graphically:

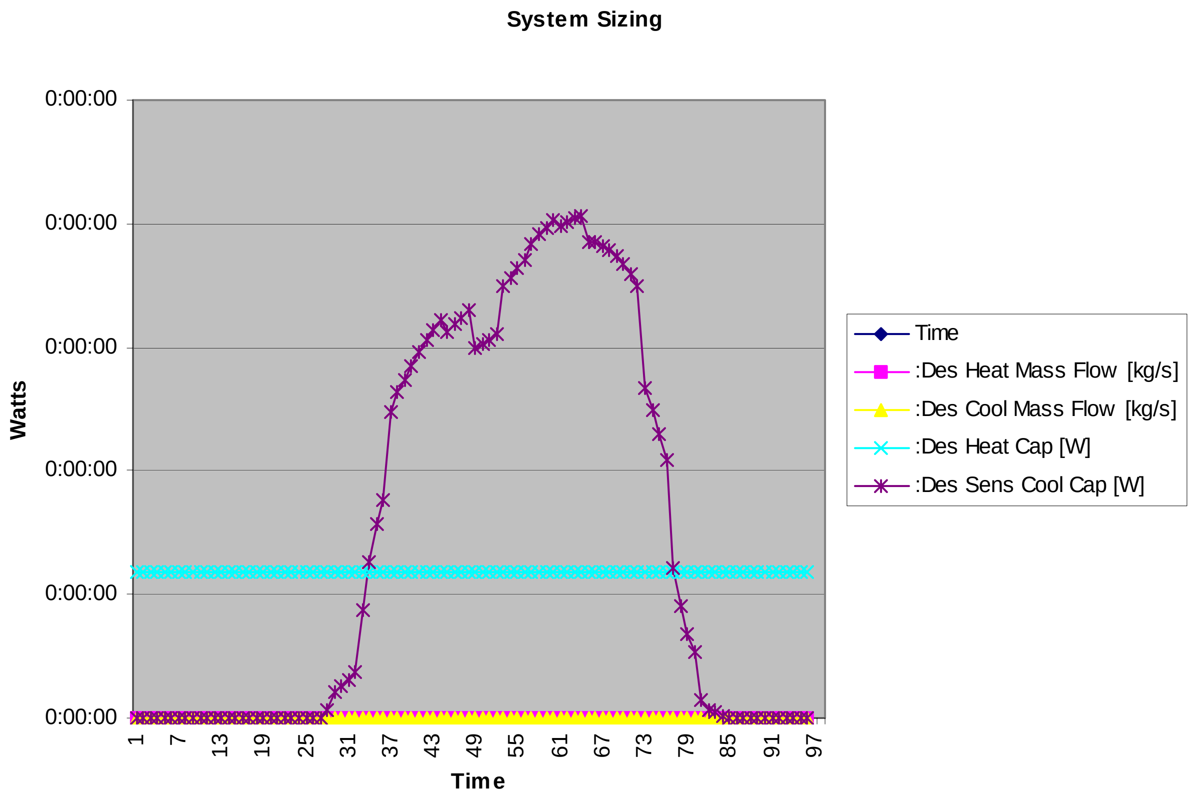

Figure 5. System Size depiction from eplusout.ssz

epluszsz.<ext>

This file is a result of the Zone Sizing Object. It has a similar format to the eplusssz.<ext> file.

An excerpt:

```
Time,SPACE1-1:CHICAGO ILLINOIS WINTER:Des Heat Load [W],SPACE1-1:CHICAGO ILLINOIS SUMMER:Des Cool Load
[W],SPACE1-1:CHICAGO ILLINOIS WINTER:Des Heat Mass Flow [kg/s],SPACE1-1:CHICAGO ILLINOIS SUMMER:Des Cool
Mass Flow [kg/s],SPACE2-1:CHICAGO ILLINOIS WINTER:Des Heat Load [W],SPACE2-1:CHICAGO ILLINOIS SUMMER:Des
Cool Load [W],SPACE2-1:CHICAGO ILLINOIS WINTER:Des Heat Mass Flow [kg/s],SPACE2-1:CHICAGO ILLINOIS
SUMMER:Des Cool Mass Flow [kg/s],SPACE3-1:CHICAGO ILLINOIS WINTER:Des Heat Load [W],SPACE3-1:CHICAGO
ILLINOIS SUMMER:Des Cool Load [W],SPACE3-1:CHICAGO ILLINOIS WINTER:Des Heat Mass Flow [kg/s],SPACE3-
1:CHICAGO ILLINOIS SUMMER:Des Cool Mass Flow [kg/s],SPACE4-1:CHICAGO ILLINOIS WINTER:Des Heat Load
[W],SPACE4-1:CHICAGO ILLINOIS SUMMER:Des Cool Load [W],SPACE4-1:CHICAGO ILLINOIS WINTER:Des Heat Mass Flow
[kg/s],SPACE4-1:CHICAGO ILLINOIS SUMMER:Des Cool Mass Flow [kg/s],SPACE5-1:CHICAGO ILLINOIS WINTER:Des
Heat Load [W],SPACE5-1:CHICAGO ILLINOIS SUMMER:Des Cool Load [W],SPACE5-1:CHICAGO ILLINOIS WINTER:Des Heat
Mass Flow [kg/s],SPACE5-1:CHICAGO ILLINOIS SUMMER:Des Cool Mass Flow [kg/s],
00:15:00,6.296981E+03,0.000000E+00,2.152065E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721081E-
02,0.000000E+00,6.033166E+03,0.000000E+00,2.061903E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721081E-
02,0.000000E+00,6.513257E+03,0.000000E+00,2.225982E-01,0.000000E+00,
00:30:00,6.296981E+03,0.000000E+00,2.152065E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721081E-
02,0.000000E+00,6.033167E+03,0.000000E+00,2.061903E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721081E-
02,0.000000E+00,6.513258E+03,0.000000E+00,2.225982E-01,0.000000E+00,
00:45:00,6.296981E+03,0.000000E+00,2.152065E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721082E-
02,0.000000E+00,6.033167E+03,0.000000E+00,2.061903E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721082E-
02,0.000000E+00,6.513258E+03,0.000000E+00,2.225982E-01,0.000000E+00,
01:00:00,6.296981E+03,0.000000E+00,2.152065E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721082E-
02,0.000000E+00,6.033167E+03,0.000000E+00,2.061903E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721082E-
02,0.000000E+00,6.513258E+03,0.000000E+00,2.225982E-01,0.000000E+00,
01:15:00,6.296981E+03,0.000000E+00,2.152065E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721082E-
02,0.000000E+00,6.033167E+03,0.000000E+00,2.061903E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721082E-
02,0.000000E+00,6.513259E+03,0.000000E+00,2.225982E-01,0.000000E+00,
01:30:00,6.296982E+03,0.000000E+00,2.152065E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721082E-
02,0.000000E+00,6.033167E+03,0.000000E+00,2.061903E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721082E-
02,0.000000E+00,6.513259E+03,0.000000E+00,2.225982E-01,0.000000E+00,
01:45:00,6.296982E+03,0.000000E+00,2.152065E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721083E-
02,0.000000E+00,6.033167E+03,0.000000E+00,2.061904E-01,0.000000E+00,2.551769E+03,0.000000E+00,8.721083E-
02,0.000000E+00,6.513259E+03,0.000000E+00,2.225983E-01,0.000000E+00,
02:00:00,6.296982E+03,0.000000E+00,2.152065E-01,0.000000E+00,2.551770E+03,0.000000E+00,8.721083E-
02,0.000000E+00,6.033167E+03,0.000000E+00,2.061904E-01,0.000000E+00,2.551770E+03,0.000000E+00,8.721083E-
02,0.000000E+00,6.513259E+03,0.000000E+00,2.225983E-01,0.000000E+00,
02:15:00,6.296982E+03,0.000000E+00,2.152065E-01,0.000000E+00,2.551770E+03,0.000000E+00,8.721083E-
02,0.000000E+00,6.033168E+03,0.000000E+00,2.061904E-01,0.000000E+00,2.551770E+03,0.000000E+00,8.721083E-
02,0.000000E+00,6.513260E+03,0.000000E+00,2.225983E-01,0.000000E+00,
02:30:00,6.296982E+03,0.000000E+00,2.152065E-01,0.000000E+00,2.551770E+03,0.000000E+00,8.721083E-
02,0.000000E+00,6.033168E+03,0.000000E+00,2.061904E-01,0.000000E+00,2.551770E+03,0.000000E+00,8.721083E-
02,0.000000E+00,6.513260E+03,0.000000E+00,2.225983E-01,0.000000E+00,
02:45:00,6.296982E+03,0.000000E+00,2.152065E-01,0.000000E+00,2.551770E+03,0.000000E+00,8.721083E-
02,0.000000E+00,6.033168E+03,0.000000E+00,2.061904E-01,0.000000E+00,2.551770E+03,0.000000E+00,8.721083E-
02,0.000000E+00,6.513260E+03,0.000000E+00,2.225983E-01,0.000000E+00,
=== reduced for brevity ===
```

```
Peak         ,6.296985E+03,2.619306E+03,2.152066E-01,2.590662E-01,2.551771E+03,1.974645E+03,8.721088E-
02,1.953002E-01,6.033171E+03,2.481187E+03,2.061905E-01,2.454047E-01,2.551771E+03,2.485711E+03,8.721088E-
02,2.458426E-01,6.513265E+03,2.519922E+03,2.225985E-01,2.492472E-01,
Peak Vol Flow,6.296985E+03,2.619306E+03,1.827742E-01,2.200241E-01,2.551771E+03,1.974645E+03,7.406790E-
02,1.658678E-01,6.033171E+03,2.481187E+03,1.751169E-01,2.084213E-01,2.551771E+03,2.485711E+03,7.406790E-
02,2.087933E-01,6.513265E+03,2.519922E+03,1.890521E-01,2.116848E-01,
```

Or as depicted in a chart:

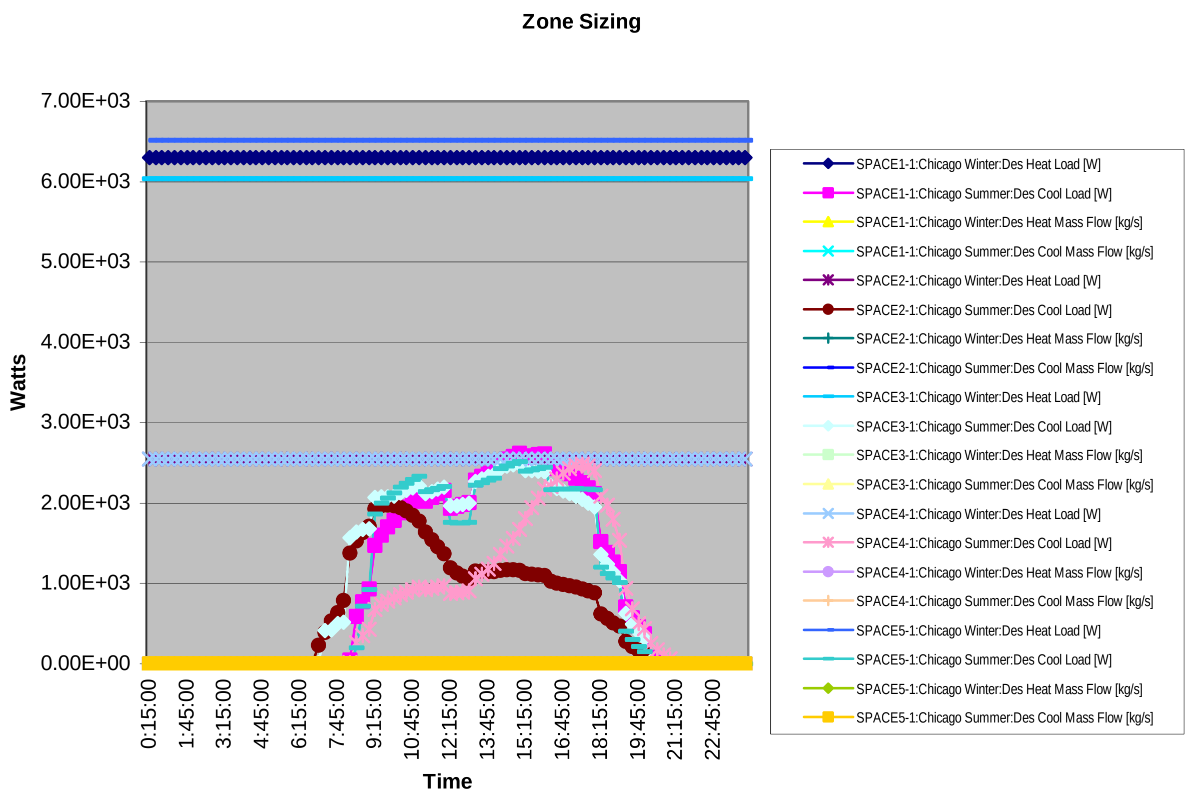

Figure 6. Zone Sizing from epluszsz.csv

eplusout.<ext>

eplusmtr.<ext>

The eplusout.csv and eplusmtr.csv are files that can be produced by post-processing on the eplusout.eso and eplusout.mtr files, respectively. EnergyPlus distributes a post-processing program (ReadVarsESO – see next section) with the installation. Be warned that, though ReadVarsESO can produce the files, it may be slow – it may take as long to produce the files as running EnergyPlus itself. Future releases will hopefully show improved speed in the ReadVarsESO execution.

eplusmap.<ext>

Results of the “daylight illuminance” map. These files can be used to create a “flip chart” that will illustrate the illumination of a zone throughout the daylight hours.

eplustbl.<ext>

Results of any “table” reports. This includes, but is not limited to, the “Report Table” objects, the Economic and Cost objects.

eplusout.svg

This is a Scalable Vector Graphics (SVG) file that shows a diagram of the HVAC system from the inputs of the simulation. Several viewers are available so that you can view these files.

eplusout.sci

This is the cost information report.

eplusout.cfp

This is the constrained free parameters report.

Delight output files

eplusout.delightin

Following completion of an EnergyPlus run that includes Daylighting:DElight objects, an ASCII text file created during the run is given a file name that consists of the project name and the extension DElightIN (e.g., MyProject.DElightIN).

This text file is a formatted DElight input file that was created from the EnergyPlus input data relevant to a DElight simulation. This file can be manually reviewed to determine the exact data that were transformed from EnergyPlus into DElight input.

eplusout.delightout

Following completion of an EnergyPlus run that includes Daylighting:DElight objects, an ASCII text file created during the run is given a file name that consists of the project name and the extension DElightOUT (e.g., MyProject.DElightOUT).

This text file is a formatted DElight output file that was generated by the DElight simulation engine following the pre-processing daylight factors calculation. This file can be manually reviewed to see the results of these calculations. The file contains an echo of DElight input data, as well as the results of intermediate calculations such as geometrical transformations, surface gridding, and daylight factors, including the following.

Surface Data

- Vertex coordinates in the Building coordinate system. Search for the string “BldgSystem_Surface_Vertices” within the output file.
- Exterior face luminance values under overcast skies, and for each sun position under clear skies. Search for the string “Surface Exterior Luminance” within the output file.
- Common data for radiosity nodal patches for each surface including Area and Number of Nodes. Search for the string “Surface_Node_Area” within the output file.
- Individual data for radiosity nodal patches for each node on each surface including: building coordinate system coordinates; direct and total luminance values under overcast skies, and for each sun position under clear skies. Search for the string “BldgSystem_Node_Coordinates” within the output file.

Reference Point Data

- Illuminance values from the daylighting factors preprocessor for overcast skies, and for each sun position under clear skies.
- Daylight Factor values from the daylighting factors preprocessor for overcast skies, and for each sun position under clear skies.

- NOTE: The Monthly Average data for Daylight Illuminances and Electric Lighting Reduction will all be zero since these data are not calculated as part of the pre-processing done by the point at which this output file is generated for EnergyPlus.

eplusout.delightdfdmp

Following completion of an EnergyPlus run that includes Daylighting:DElight objects, an ASCII text file created during the run is given a file name that consists of the project name and the extension DElightDFdmp (e.g., MyProject.DElightDFdmp).

This text file contains any warning or error messages that may have been generated by the DElight calculation engine during the pre-processing calculation of a full set of daylight factors. This file should ordinarily be empty.

eplusout.delighteldmp

Following completion of an EnergyPlus run that includes Daylighting:DElight objects, an ASCII comma-separated value (CSV) text file created during the run is given a file name that consists of the project name and the extension DElightELdmp (e.g., MyProject.DElightELdmp).

This text file is generated during the EnergyPlus timestep calculations performed by the DElight calculation engine. The comma-separated values include Zone Name, Reference Point Name, and Daylighting Illuminance Level (lux), with one row for each timestep calculation in the EnergyPlus run.

This text file also contains any warning or error messages that may have been generated by the DElight calculation engine during the timestep calculations. There should not ordinarily be any of these messages interspersed with the illuminance value output.

Example Input Files

The full EnergyPlus install includes a myriad of example input files. For the most part, the developers create these files to illustrate and test a specific feature in EnergyPlus. Then, we pass them along to you for illustrative purposes.

Following convention, each example file should have at the top a set of comments that tell what the purpose of the file is and the key features.

For example, the file titled "5ZoneAirCooled.idf" has:

```
! 5ZoneAirCooled.idf
! Basic file description: 1 story building divided into 4 exterior and
!   one interior conditioned zones and a return plenum.
! Building: single floor rectangular building 100 ft x 50 ft. 5 zones -
!           4 exterior, 1 interior, zone height 8 feet. Exterior zone
!           depth is 12 feet. There is a 2 foot high return plenum: the
!           overall building height is 10 feet. There are windows on
!           all 4 facades; the south and north facades have glass doors.
!           The south facing glass is shaded by overhangs. The walls
!           are woodshingle over plywood, R11 insulation, and gypboard.
!           The roof is a gravel built up roof with R-3 mineral board
!           insulation and plywood sheathing. The floor slab is 4 inches
!           of heavy concrete over 2 feet of dirt. The windows are double
!           pane 6mm clear with 6mm air gap.  The window to wall ratio is
!           approxomately 0.29.
!
!           The building is oriented 30 degrees east of north.
!
! Internal: lighting is 1.5 watts/ft2, office equip is 1.0 watts/ft2. There
!           is 1 occupant per 100 ft2 of floor area. The infiltration is
!           0.25 air changes per hour.
! HVAC:     Standard VAV system with outside air economizer, hot water reheat
!           coils, central chilled water cooling coil. Central Plant is
!           single hot water boiler, electric compression chiller with air
!           cooled condenser. All equipment is autosized.
```

In addition to the idf files, usually an .rvi and perhaps a .mvi of the same file set is included. As discussed previously, the .rvi is used with the ReadVarsESO post-processing program and the .eso file to create a .csv file which can be read easily into Excel™. Like the .rvi, the .mvi file can be used with the .mtr file to create a similar version for "metered" outputs.

Files included in V1.2.1

1ZoneUncontrolled.idf

This is almost the simplest conceivable input file – 4 walls, no roof, no floor, no HVAC. Also shown as the sample in Input Output Reference document. Starting with V1.2.1, it generates a severe error due to the fact it has all "R" material walls.

3zvent.idf, 3zventAutoCalcOfWindPressureCoeffs

(3zvent is described below, 3zventAutoCalcOfWindPressure Coeffs is the same building as 3zvent but uses the program to automatically calculate the Wind Pressure Coefficients).

```
! 3-zone building with natural ventilation modeled by COMIS/EnergyPlus link. 3zvent.idf.
!
! See plan view of building, below, for location of air-flow openings and cracks.
!
! Natural ventilation takes places through openable exterior windows in WEST_ZONE and NORTH_ZONE
   ! and an openable interior door between WEST_ZONE and NORTH_ZONE. The ventilation is temperature
   ! controlled. Window1 in WEST_ZONE and DoorInSurface_3 (defined in WEST_ZONE) are opened when
   ! (1) the previous time step air temperature in WEST_ZONE is greater than the ventilation setpoint
   ! schedule value (a fixed value of 21.1C in this run) and (2) the previous time step air temperature
   ! in WEST_ZONE is greater than the outside air temperature. Similarly, Window2 in NORTH_ZONE is
   ! opened when (1) the previous time step air temperature in NORTH_ZONE is greater than the
   ! ventilation setpoint schedule value and the previous time step air temperature in NORTH_ZONE is
   ! greater than the outside air temperature.
   !
   ! Controls to modulate the ventilation openings are applied to the WEST_ZONE but not the NORTH_ZONE
   ! (see the COMIS ZONE DATA inputs for these zones).
   !
   ! The EAST_ZONE has no natural ventilation (Ventilation Control Mode = NoVent in the COMIS ZONE DATA
   ! input for this zone).
   !
   ! In addition to natural ventilation in two of the zones, there are cracks in all exterior and
   ! interior walls. Cracks in the exterior walls allow infiltration of outside air into the zones.
   ! The interior doorway and cracks in the interior walls allow cross-mixing of air between zones
   ! (i.e., interzone air flow). There are no cracks in the roof surfaces.
   !
   !
   !                            * External Node NFacade
   !
   !                       Window2    Crack
   !            *********[         ]***//****************
   !            |                                        |
   !            |                                        |
   !            |                                        |
   !            / Crack                                  / Crack
   !            /              NORTH_ZONE                /
   !            |                                        |
   !            |                                        |
   ! * External |       DoorInSurface_3         Crack    |
   !   Node     *****//**]  [**********//********//******   * External Node EFacade
   !   WFacade  |  Crack             | Crack             |
   !            |                    |                   |
   !            |                    |                   |
   !            / Crack              / Crack             / Crack
   !            /                    /                   /
   !            |                    |                   |
   !            |    WEST_ZONE       |     EAST_ZONE     |
   !            |                    |                   |
   !            |                    |                   |
   !            **//*[          ]************//***********
   !                 Window1            Crack
   !
   !                             * External Node SFacade
   !
   !         Plan view of 3-zone building showing location of openable
   !         windows ([ ]), openable door (] [) and cracks (//).
   !         Not to scale.
```

5Zone files

The files entitled "5Zone**xxxx**" have the same basic floor plan and then add features. Most of them illustrate autosizing.

5ZoneAirCooled.idf

5ZoneAirCooledConvCoef.idf

5ZoneAuto.idf

5ZoneAutoDXVAV.idf

5ZoneBoilerOutsideAirReset.idf

5ZoneCostEst.idf

5ZoneDD.idf

5ZoneDDCycOnAny.idf

5ZoneDDCycOnOne.idf

5ZoneDesignInputCoolingCoil.idf

5ZoneEconomicsTariff.idf

5ZoneEngChill.idf

5ZoneFPIU.idf

5ZoneReturnFan.idf

5ZoneSupRetPlen.idf

5ZoneSupRetPlenVSATU.idf

5ZoneWarmest.idf

5ZoneWaterCooled.idf

5ZoneWaterCooled_HighRHControl.idf

5ZoneWaterCooledDetCoil.idf

5ZoneWaterLoopHeatPump.idf

5ZoneWLHPPlantLoopTower.idf

AbsorptionChiller.idf

ActiveTrombeWall.idf

ADS_<files>

The files beginning with “ADS” illustrate the Air Distribution System included with EnergyPlus.

ADS_COMIS_House.idf

ADS_COMIS_SmallOffice.idf

ADS_SIMPLE_House.idf

ADS_SIMPLE_SmallOffice.idf

ADSModel_House_1.idf

ADSModel_SmallOffice_1.idf

AirCooledElectricChiller.idf

AirflowWindowsAndBetweenGlassBlinds.idf

BaseBoardElectric.idf

CondFD1ZonePurchAirAutoSize.idf

Convection.idf

CoolingTower.idf

CoolingTowerNomCap.idf

CoolingTowerWithDeltaTempOp.idf

CVBbRh.idf

CVRhMinHum.idf

CVRhMinHumNoOA.idf

DaylightingDeviceShelf.idf

DaylightingDeviceTubular.idf

DDAutoSize.idf

DElight files

The files beginning with “DElight” illustrate the use of DElight augmentation in EnergyPlus.

DElightCFSLightShelf.idf

DElightCFSWindow.idf

DElight-Detailed-Comparison.idf

DElightSimpleWindow.idf

DesiccantCVRh.idf

DHWPurchHeating.idf

DisplacementVent files

The files beginning with "DisplacementVent" illustrate the Displacement Ventilation option of EnergyPlus.

DisplacementVent_1ZoneOffice.idf

DisplacementVent_Nat.idf

DisplacementVent_VAV.idf

DualDuctConstVolDamper.idf

DualDuctConstVolGasHC.idf

DualDuctVarVolDamper.idf

DualDuctWaterCoils.idf

DXSys.idf

DXSysWithHR.idf

ElectricChiller.idf

ElectricEIRChiller.idf

EMPDTermReheat.idf

EngineChiller.idf

FanCoil.idf

FanCoilAutoSize.idf

Flr_Rf_8Sides.idf

FPIUCC.idf

FreeCoolingChiller.idf

Furnace.idf

FurnaceDXAuto.idf

FurnacePLRHeatingCoil.idf

FurnaceWithDXSystem.idf

FurnaceWithDXSystem_CoolingHXAssisted.idf

FurnaceWithDXSystemRHcontrol.idf

gasAbsorptionChillerHeater.idf

GasTurbChiller.idf

Generators.idf

GeneratorswithPV.idf

GeometryTest.idf

GroundTempOSCCompactSched.idf

GSHP-GLHE.idf

HeatPump.idf

HeatPumpAuto.idf

HeatPumpCycFanWithEcono.idf

HeatPumpSimpleDCV.idf

HeatPumpWaterToAir.idf

HeatRecoveryElectricChiller.idf

HeatRecoveryPlantLoop.idf

HeatRecoverywithStorageTank.idf

HVACStandAloneERV_Economizer.idf

IndEvapCoolerRTUoffice.idf

LgOffVAV.idf

LgOffVAVDetCoil.idf

MeterTest.idf

MFD1ZonePurchAirAutoSize.idf

Minimal.idf

MovableExtInsulationSimple.idf

MTFTermReheat.idf

MultiStory.idf

Mundt_System_Always_On.idf

Mundt_System_On_During_the_Day.idf

PassiveTrombeWall.idf

PIUAuto.idf

PlantLoadProfile.idf

PlateHeatExchanger.idf

plenum.idf

PlenumwithRetAirHeatGain.idf

PondGroundHeatExchanger.idf

PSZ.idf

PSZDrawThru.idf

PurchAir.idf

PurchAirAutoSize.idf

PurchAirTables.idf

PurchAirWindowBlind.idf

PurchAirWithDaylighting.idf

PurchAirWithDaylightingAngleFac.idf

PurchAirWithDoubleFacadeDaylighting.idf

QTFtest.idf

RadHiTempElecTermReheat.idf

RadHiTempGasCtrlOpt.idf

RadHiTempGasTermReheat.idf

RadLoHydrHeatCoolAuto.idf

RadLoTempCFloHeatCool.idf

RadLoTempCFloTermReheat.idf

RadLoTempElecTermReheat.idf

RadLoTempHydrCoolTower.idf

RadLoTempHydrCtrlOpt.idf

RadLoTempHydrCtrlOpt2.idf

RadLoTempHydrHeatCool.idf

RadLoTempHydrHeatCool2D.idf

RadLoTempHydrHeatCoolDry.idf

RadLoTempHydrInterMulti.idf

RadLoTempHydrMulti10.idf

RadLoTempHydrTermReheat.idf

ReflectiveAdjacentBuilding.idf

ReliefIndEvapCoolerRTUoffice.idf

SmOffPSZ.idf

SolarCollectorFlatPlateWater.idf

SolarShadingTest.idf

SolarShadingTestAnn.idf

StormWindow.idf

SupplyPlenumVAV.idf

SurfaceGroundHeatExchanger.idf

SurfaceTest.idf

SZRh.idf

SZRhDrawThru.idf

TermReheat.idf

TermReheatOA.idf

TermReheatOAReset.idf

TermReheatOAResiz.idf

TermReheatOASizAndRun.idf

TermReheatPri-SecLoop.idf

TermReheatScheduledPump.idf

TermReheatSurfTC.idf

TermReheatZoneExh.idf

TermRhDualSetpointWithDB.idf

TermRHDXSystem.idf

TermRHGasElecCoils.idf

TermRhGenericOAHeatRecMinExh.idf

TermRhGenericOAHeatRecPreheat.idf

TermRhOAHeatRec.idf

TermRhSingleHeatCoolNoDB.idf

TransparentInsulationSimple.idf

TRHConstFlowChillerOneBranch.idf

TRHEvapCoolerOAStaged.idf

UnitHeater.idf

UnitHeaterAuto.idf

UnitHeaterGasElec.idf

UnitVentAuto.idf

UnitVentGasElec.idf

UnitVentGEAuto.idf

UnitVentilator.idf

VAVRhWithPIU.idf

VAVSingleDuctConstFlowBoiler.idf

VAVSingleDuctReheat.idf

VAVSingleDuctReheatBaseboard.idf

VAVSingleDuctReheatNoReheat.idf

VAVSingleDuctVarFlowBoiler.idf

VentilationSimpleTest.idf

WaterHeaterStandAlone.idf

WeatherTimeBins.idf

WindAC.idf

WindACAuto.idf

WindACRHControl.idf

WindowTests.idf

Data Sets

Data sets are the EnergyPlus answer to “libraries”. Data sets come in two flavors – a simple list and a “macroized” list. Macroized lists are files that could have the elements extracted using a simple macro name.

Simple List Data Sets

CompositeWallConstructions.idf

The Reference Data Set CompositeWallConstructions.idf contains constructions and associated materials for a set of **composite** walls. These are walls—such as stud walls—that have complicated heat-flow paths so that the conduction is two- or three-dimensional.

An example entry in this data set--for an insulated 2”x4” steel-stud wall--looks like:

```
CONSTRUCTION,Composite 2x4 Steel Stud R11,
! ASHRAE 1145-RP Wall Assembly 10
! 2"x4" steel studs at 24" on center with between-stud R11 fibreglass insulation.
! Studs are 3.5", 16 gauge, 15 flange.
! Layers are 1/2" wood siding, 1/2" plywood, 2x4 steel studs and R11 insulation, 1/2" gypsum board.
! Area-average R-Value = 8.796 ft2-F-h/Btu (1.548 m2-K/W).
! Total wall thickness = 5.00in (0.127m)
! Material layer names follow:
  Composite 2x4 Steel Stud R11 #1,
  Composite 2x4 Steel Stud R11 #2,
  Composite 2x4 Steel Stud R11 #3;
MATERIAL:REGULAR,Composite 2x4 Steel Stud R11 #1,
  Smooth,  !- Roughness
  0.013,   !- Thickness (m)
  0.720,   !- Conductivity (W/m-K)
  640.0,   !- Density (kg/m3)
  1048,    !- Specific Heat (J/kg-K)
  0.9,     !- Absorptance:Thermal
  0.7,     !- Absorptance:Solar
  0.7;     !- Absorptance:Visible
MATERIAL:REGULAR,Composite 2x4 Steel Stud R11 #2,
  Smooth,  !- Roughness
  0.089,   !- Thickness (m)
  0.060,   !- Conductivity (W/m-K)
  118.223, !- Density (kg/m3)
  1048,    !- Specific Heat (J/kg-K)
  0.9,     !- Absorptance:Thermal
  0.7,     !- Absorptance:Solar
  0.7;     !- Absorptance:Visible
MATERIAL:REGULAR,Composite 2x4 Steel Stud R11 #3,
  Smooth,  !- Roughness
  0.025,   !- Thickness (m)
  0.452,   !- Conductivity (W/m-K)
  413.782, !- Density (kg/m3)
  1048,    !- Specific Heat (J/kg-K)
  0.9,     !- Absorptance:Thermal
  0.7,     !- Absorptance:Solar
  0.7;     !- Absorptance:Visible
```

The materials here are **not** real materials but are “equivalent” materials obtained from finite-difference modeling.[1] EnergyPlus will calculate conduction transfer functions using these

[1] The thickness, conductivity, density and specific heat values of the material layers for the different constructions have been taken from the ASHRAE report “Modeling Two- and Three-Dimensional Heat Transfer through Composite Wall and Roof Assemblies in Hourly Energy Simulation Programs (1145-TRP),” by Enermodal Engineering Limited, Oak Ridge National Laboratory, and the Polish Academy of Sciences, January 2001.

materials. The heat transfer based on these conduction transfer functions will then be very close to what would be calculated with a two- or three-dimensional heat transfer calculation.

For stud walls, using these composite constructions will give more accurate heat flow than you would get by manually dividing the wall into a stud section and a non-stud section.

If your wall's exterior or interior roughness or thermal, solar or visible absorptances are different from those in the data set, you can make the appropriate changes to the first material (the outside layer) or the third material (the inside layer). **None of the other values should be changed.**

Following is a summary of the constructions in the composite wall data set:

```
CONSTRUCTION,Composite 2x4 Wood Stud R11,
! ASHRAE 1145-RP Wall Assembly 1
! 2"x4" wood studs at 24" on center with between-stud R11 fibreglass insulation.
! Layers are 1/2" wood siding, 1/2" plywood, 2x4 wood studs and R11 insulation, 1/2" gypsum board.
! Area-average R-Value = 11.391 ft2-F-h/Btu (2.005 m2-K/W).

CONSTRUCTION,Composite 2x6 Wood Stud R19,
! ASHRAE 1145-RP Wall Assembly 2
! 2"x6" wood studs at 24" on center with between-stud R19 fibreglass insulation.
! Layers are 1/2" wood siding, 1/2" plywood, 2x6 wood studs and R19 insulation, 1/2" gypsum board.
! Area-average R-Value = 17.487 ft2-F-h/Btu (3.078 m2-K/W).

CONSTRUCTION,Composite Insulated Concrete Form Wall With Steel Ties,
! ASHRAE 1145-RP Wall Assembly 7
! Wall system is made of two rigid insulation sides held together with wire mesh.
! The two sides come together to create the formwork for the concrete.
! Layers are 3/4" concrete stucco, outer polystyrene shell, concrete core, inner polystyrene shell.
! Area-average R-Value = 11.230 ft2-F-h/Btu (1.977 m2-K/W).

CONSTRUCTION,Composite Concrete/Foam/Concrete With Steel Connectors,
! ASHRAE 1145-RP Wall Assembly 8
! Wall system is made of two 3" concrete slabs separated by 2" rigid insulation.
! The slab connectors are steel ties with a 0.15"x0.15" cross section.
! Layers are 3" concrete, 2" polystyrene, 3" concrete.
! Area-average R-Value = 7.659 ft2-F-h/Btu (1.348 m2-K/W).

CONSTRUCTION,Composite Concrete/Foam/Concrete With Plastic Connectors,
! ASHRAE 1145-RP Wall Assembly 9
! Wall system is made of two 3" concrete slabs separated by 2" rigid insulation.
! The slab connectors are plasic ties with a 0.25"x0.25" cross section.
! Layers are 3" concrete, 2" polystyrene, 3" concrete.
! Area-average R-Value = 10.582 ft2-F-h/Btu (1.862 m2-K/W).

CONSTRUCTION,Composite 2x4 Steel Stud R11,
! ASHRAE 1145-RP Wall Assembly 10
! 2"x4" steel studs at 24" on center with between-stud R11 fibreglass insulation.
! Studs are 3.5", 16 gauge, 15 flange.
! Layers are 1/2" wood siding, 1/2" plywood, 2x4 steel studs and R11 insulation, 1/2" gypsum board.
! Area-average R-Value = 8.796 ft2-F-h/Btu (1.548 m2-K/W).

CONSTRUCTION,Composite Brick Foam 2x4 Steel Stud R11,
! ASHRAE 1145-RP Wall Assembly 15
! Brick veneer, polystyrene, 2"x4" steel studs at 24" on center with
!  between-stud R11 fibreglass insulation.
! Studs are 3.5", 16 gauge, 15 flange.
! Layers are 3.25" brick,1" polystyrene insulation, 1/2" plywood, 2x4 steel studs and R11 insulation,
!  1/2" gypsum board.
! Area-average R-Value = 12.792 ft2-F-h/Btu (2.251 m2-K/W).

CONSTRUCTION,Composite 2x6 Steel Stud R19,
! ASHRAE 1145-RP Wall Assembly 16
! 2"x6" steel studs at 24" on center with between-stud R19 fibreglass insulation.
! Studs are 5.5", 16 gauge, 15 flange.
! Layers are 1/2" wood siding, 1/2" plywood, 2x6 steel studs and R19 insulation, 1/2" gypsum board.
! Area-average R-Value = 12.792 ft2-F-h/Btu (1.991 m2-K/W).
```

```
CONSTRUCTION,Composite Foam 2x6 Steel Stud R19,
! ASHRAE 1145-RP Wall Assembly 17
! Polystyrene, 2"x6" steel studs at 24" on center with between-stud R19 fibreglass insulation.
! Studs are 5.5", 16 gauge, 15 flange.
! Layers are 3/4" concrete stucco,1" polystyrene insulation, 1/2" plywood, 2x6 steel studs and R19
insulation,
!  1/2" gypsum board.
! Area-average R-Value = 15.157 ft2-F-h/Btu (2.668 m2-K/W).

CONSTRUCTION,Composite Brick Foam 2x6 Steel Stud R19,
! ASHRAE 1145-RP Wall Assembly 18
! Brick veneer, polystyrene, 2"x6" steel studs at 24" on center with
!  between-stud R19 fibreglass insulation.
! Studs are 5.5", 16 gauge, 15 flange.
! Layers are 3.25" brick,1" polystyrene insulation, 1/2" plywood, 2x6 steel studs and R19 insulation,
!  1/2" gypsum board.
! Area-average R-Value = 15.465 ft2-F-h/Btu (2.722 m2-K/W).

CONSTRUCTION,Composite 2-Core Filled Concrete Block Uninsulated,
! ASHRAE 1145-RP Wall Assembly 19
! Wall system is made of 12" 2-core concrete blocks without insulation.
! The core area is filled with rebar and poured concrete.
! Area-average R-Value = 1.326 ft2-F-h/Btu (0.239 m2-K/W).

CONSTRUCTION,Composite 2-Core Filled Concrete Block Insulated,
! ASHRAE 1145-RP Wall Assembly 20
! Wall system is made of 12" 2-core concrete blocks with 1.875"-thick
!  foam inserts in the block cores.
! The remaining core area is filled with poured concrete.
! Area-average R-Value = 2.291 ft2-F-h/Btu (0.403 m2-K/W).
```

Electricity USA Environmental Impact Factors.idf

Fossil Fuel Environmental Impact Factors.idf

Impact factors for environmental reporting.

FluidPropertiesRefData.idf

This data set includes fluid properties reference data. Included are:

Refrigerants
R11
R12
R22
R123
R134a
NH3
Steam

GlycolPropertiesRefData.idf

This data set includes fluid properties (glycol) reference data. Included are:

Glycols
EthyleneGlycol

PropyleneGlycol
Water

GHLERefData.idf

This file contains sample input for the ground loop heat exchanger model. The response of the borehole/ground is found from the 'G-function' that is defined in the input as series of 'n' pairs of values (LNTTSn, GNFCn). It is important to note that the G-functions have to be calculated for specific GHE configurations and borehole resitance, length and borehole/ length ratio. That is, the parameters for the units vary with each design. The data in this file are intended as examples/samples and may not represent actual designs.

The sample data has been calculated for a number of configurations:

1 x 2 boreholes

4 x 4 boreholes

8 x 8 boreholes

Data is given for both 'standard' grout (k=0.744 W/m.K) and 'thermally enhanced' grout (k= 1.471 W/m.K). The flow rate per borehole is .1514 kg/s. The pipe given is 0.75in. Dia. SDR11 HDPE. The fluid is water. The borehole/length ratio is 0.06 (76.2m/4.572m [300ft/15ft])

MoistureMaterials.idf

This data set includes the special moisture materials that can be used with the MTF calculation procedure.

PerfCurves.idf

This file contains performance curves for variable speed DX cooling. These curves are appropriate for small DX cooling units with variable speed compressors. These curves would be referenced by the EnergyPlus object COIL:DX:MultiSpeed:CoolingEmpirical. See the example input file 5ZoneAutoDXVAV for an example of their use.

SandiaPVData.idf

Use these PV statements for implementing PV modules in an EnergyPlus input file.

Schedules.idf

This data set contains the schedule information for various common (e.g. Office Occupancy) scheduling instances. Derived from the Schedules Library issued with the BLAST program. Includes the building types schedules from ASHRAE 90.1-1989, Section 13. Schedules are listed alphabetically, with general schedules first, followed by the ten 90.1 building type schedules.

SolarCollectors.idf

Use these SOLAR COLLECTOR PARAMETERS objects for implementing solar collector modules in an EnergyPlus input file.

Data has been reproduced with permission from: "Directory of SRCC Certified Solar Collector Ratings" Copyright (c) 2004 by the Solar Rating and Certification Corporation. For more information, contact: Solar Rating and Certification Corporation,c/o FSEC, 1679 Clearlake Road, Cocoa, FL 32922-5703 USA Tel: (321) 638-1537 Fax: (321) 638-1010 srcc@fsec.ucf.edu, www.solar-rating.org

StandardReports.idf

This file contains the Report Table:Monthly command for some commonly used/desired monthly reports.

USHolidays-DST.idf

This is the set of US national holidays as well as daylight saving period defaults.

Window5DataFile.dat

This is an example data file from the Window5 program that can be used with EnergyPlus windows.

WindowBlindMaterials.idf

This is a data set of Window Blind materials.

WindowConstructs.idf

This is a data set of Window constructions. It does not include the required pieces of the Window contruction (glass materials, gas materials).

WindowGasMaterials.idf

This is a data set of Window Gas materials.

WindowGlassMaterials.idf

This is a data set of Window Glass materials.

WindowShadeMaterials.idf

This is a data set of Window Shade materials.

Data Sets from Legacy Programs (i.e. BLAST and DOE-2)

The following data sets originated in their respective programs – included for completeness.

BLASTConstructs.idf

This data set contains the "constructions" that were in the BLAST libraries (Walls, Roofs, Floors). It uses materials from the BLAST Materials data set but does not include them in this file.

BLASTDesignDays.idf

This data set contains the design days that were in the BLAST Design Days library. It references (indirectly) locations from the BLAST Locations data set.

BLASTLocations.idf

This data set contains the locations (with added elevation information) that were in the BLAST Locations library. These can be used alone or accompanying the design day information from the BLAST Design Days data set.

BLASTMaterials.idf

This data set contains the materials that were in the BLAST Materials library. These are used in the constructions shown in the BLAST Constructs data set.

DOE-2Constructs.idf

This data set contains the “constructions” that were in the DOE-2 libraries. It uses materials from the DOE-2 Materials data set but does not include them in this file.

DOE-2Materials.idf

This data set contains the materials that were in the DOE-2 Materials library. These are used in the constructions shown in the DOE-2 Constructs data set.

Macro Data Sets

Locations-DesignDays.xls

Strictly speaking, the locations-designdays.xls file is not a macro enabled input file. Rather, it is the “pointer” to other files and can be searched by city name, country, etc. The first few lines of the file (which is tab-delimited and easily readable by Excel™) illustrate how it can be used:

City	State/Province	Country	Key Name	File where located
WILLEMSTAD		NETHERLANDS ANTILLES	ANT_WILLEMSTAD	WorldDesignDayDefinitions
ABU_DHABI		UNITED ARAB EMIRATES	ARE_ABU_DHABI	WorldDesignDayDefinitions
DUBAI		UNITED ARAB EMIRATES	ARE_DUBAI	WorldDesignDayDefinitions

Figure 7. Illustration for Locations-Design Days Index File

To use the file, you can sort or search on city name, state / province, country. The Key_Name column indicates the “macro name” for the location/design day group and the File where located column indicates one of the following files. You can then either view and copy the appropriate data or use the EP-Macro program to do it for you with a judicious set of input requests.

So, for example, using:

```
##def1 USA_PA_PHILADELPHIA_WILLOW_GROVE_NAS
##includesilent e:\eplus\MacroDataSets\USDesignDayDefinitions.imf
```

will include in the input file, the location and design day objects for Philadelphia, PA Willow Grove Naval Air Station or:

```
Location,
  PHILADELPHIA_WILLOW_GROVE_NAS Design_Conditions,     !- Location Name
   40.20000     ,     !- Latitude {N+ S-}
  -75.15000     ,     !- Longitude {W- E+}
  -5.000000     ,     !- Time Zone Relative to GMT {GMT+/-}
   110.0000     ;     !- Elevation {m}

 ! Using Design Conditions from "United States Climate Design Data 2001 ASHRAE Handbook"

 ! PHILADELPHIA_WILLOW_GROVE_NAS Heating 99.6%, MaxDB= -12.00 Wind Speed=   2.40 Wind Dir= 300.00
  <actual data not included for brevity>

 ! PHILADELPHIA_WILLOW_GROVE_NAS Heating 99%, MaxDB=  -9.80 Wind Speed=   2.80 Wind Dir= 250.00
 <actual data not included for brevity>

 ! PHILADELPHIA_WILLOW_GROVE_NAS Cooling (DB=>MWB) .4%, MaxDB=  34.00 MWB=  23.70
<actual data not included for brevity>

 ! PHILADELPHIA_WILLOW_GROVE_NAS Cooling (DB=>MWB) 1%, MaxDB=  32.20 MWB=  23.20
<actual data not included for brevity>

 ! PHILADELPHIA_WILLOW_GROVE_NAS Cooling (DB=>MWB) 2%, MaxDB=  30.90 MWB=  22.30
<actual data not included for brevity>

 ! PHILADELPHIA_WILLOW_GROVE_NAS Cooling (WB=>MDB) .4%, MDB=  31.70 WB=  25.30
<actual data not included for brevity>

! PHILADELPHIA_WILLOW_GROVE_NAS Cooling (WB=>MDB) 1%, MDB=  30.30 WB=  24.50
<actual data not included for brevity>

 ! PHILADELPHIA_WILLOW_GROVE_NAS Cooling (WB=>MDB) 2%, MDB=  29.20 WB=  23.70
<actual data not included for brevity>

 ! PHILADELPHIA_WILLOW_GROVE_NAS Cooling (DP=>MDB) .4%, MDB=  28.50 DP=  23.60 HR=   0.02
<actual data not included for brevity>

 ! PHILADELPHIA_WILLOW_GROVE_NAS Cooling (DP=>MDB) 1%, MDB=  27.70 DP=  22.90 HR=   0.02
<actual data not included for brevity>

 ! PHILADELPHIA_WILLOW_GROVE_NAS Cooling (DP=>MDB) 2%, MDB=  27.30 DP=  21.70 HR=   0.02
<actual data not included for brevity>
```

Design day “definitions” originate in the ASHRAE Handbook of Fundamentals. Prior to 1997, these conditions were described for winter and summer (heating and cooling). They were based on seasonal percentages.

Beginning in 1997, and continuing (the latest version was published in 2001), the design condition data is based on annual percentages. In addition, only locations with long-term hourly observations data (on which to form the basis) are included. (The specifics for each location can be seen in the USDesignConditions, CanadaDesignConditions and WorldDesignConditions files that are used in the Weather Converter – see the Auxiliary Programs document). The data sets embody the conditions contained in the Weather Converter files – into a form usable by EnergyPlus for Design Day definitions.

[From ASHRAE Handbook of Fundamentals, 2001]:

- Heating conditions are often used in the sizing of heating equipment. In cold spells, dry-builb temperatures below the design conditions can last for a week or more.
- The first cooling conditions, based on dry-bulb temperatures (i.e., DB=>MWB), often represent conditions on hot, mostly sunny days. These are useful for cooling applications, especially air-conditioning.
- Design conditions based on wet-bulb temperatures (i.e., WB=>MDB) represent extremes of the total sensible plus latent heat of outdoor air. This information is useful for cooling towers, evaporative coolers, and fresh air ventilation system design.

- Design conditions based on dew-point temperatures (i.e., DP=>MDB) are directly related to extremes of humidity ratio, which represent peak moisture loads from the weather. Extreme dew-point conditions may occur on days with moderate dry-bulb temperatures resulting in relatively high humidity. These values are especially useful for applications involving humidity control, such as desiccant cooling and dehumidification, cooling-based dehumidification, and fresh air ventilation systems. These values are also used as a check point when analyzing the behavior of cooling systems at part load conditions, particularly when such systems are used for humidity control as a secondary function.

BLASTLocationsDesignDays.imf

This data set came from BLAST location and design days originally and represent pre-1997 design conditions for the locations listed. As noted above, these design conditions were based on seasonal percentages – these represent the 2.5% conditions.

CanadaDesignDayDefinitions.imf

This data set is from the Canadian design conditions represented in ASHRAE Handbook of Fundamentals, Chapter F27, Tables 2A and 2B.

USDesignDayDefinitions.imf

This data set is from the United States design conditions represented in ASHRAE Handbook of Fundamentals, Chapter F27, Tables 1A and 1B.

WorldDesignDayDefinitions.imf

This data set is from the World design conditions represented in ASHRAE Handbook of Fundamentals, Chapter F27, Tables 3A and 3B.

SandiaPVData.idf

Use these PV statements for implementing PV modules in an EnergyPlus input file.

SolarCollectors.idf

Use these SOLAR COLLECTOR PARAMETERS objects for implementing solar collector modules in an EnergyPlus input file.